Analysis of new electrification schemes in the Western Cape (Phase 4)

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1. Project objective

The objective of this longitudinal study has been to examine electricity use in newly electrified, poor urban settlements in the Western Cape, by monitoring and analysing household energy consumption data and relevant socio-economic information. One of the primary objectives is to understand factors which affect the movement from multiple fuel use to greater electricity consumption. The intention is to highlight how poor households fulfill their daily energy needs, the problems experienced with the various energy sources, including electricity, in an attempt to usefully inform the current electrification programme.

2. Project theory and methodology

This is the fourth phase of a longitudinal study which has attempted to study the same households over time. Phase 4 attempted to locate the study, `Analysis of new urban electrification schemes in the Western Cape' in a broad and holistic theoretical context that acknowledges how historical, political, economic and social factors shape energy use patterns. At the same time, the study attempts to go beyond 'the household' to unravel how gender dynamics influence decision-making around appliance use patterns. The study critiques the objectives of the electrification programme as it is currently conceived. In particular, the programme is gender-blind and there is no real and sustained attempt to include women, the primary users and managers of energy at the household level, into policy research, planning and implementation processes.

Moreover, it appears that domestic energy policy research, in general, has been accorded low priority when it is precisely in this area that the quality of people's lives can be improved most meaningfully. The current electrification programme appears to be primarily RDP target-driven. So, while Eskom will consider the programme a success if connection targets are met, there is no guarantee that people's energy needs will be satisfied in a meaningful way. In other words, access to electricity will not in itself ensure that people's lives are improved. To meet people's needs more directly, electricity and electrical appliances need to be made more affordable and accessible. An effective holistic approach demonstrates that poverty is the single most important barrier to greater use of electricity and it is, therefore, reasonable to expect, for example, that as employment opportunities improve, so electricity consumption will increase.

The issue of multiple fuel-use is explored in this study. While multiple-fuel use is common in developed countries where people can make decisions based on preference, in South Africa it is a function of poverty and a legacy of apartheid where black people's energy needs were ignored. Until electricity services to townships are made more reliable, accessible, and affordable and until people can afford the electrical appliances that go along with it, multiple fuel use in its present form is destined to continue. Multiple fuel use is by no means a negative practice. Indeed, policy makers should recognise the opportunity to promote a range of fuels in a more balanced and environmentally sustainable way.

The study also highlights several fundamental problems in the conceptualisation, planning and implementation of the study in order to inform future longitudinal studies of this nature. The most serious of these was the lack of continuity with regard to personnel over the four phases and this resulted in variations in approach and methodology.

The study compares electricity consumption patterns of three African townships in Western Cape, namely Langa, Guguletu (both of which have been electrified for over twenty years) and Khayelitsha (which has only recently been electrified). As in previous phases, there were two primary sources of information. First, the electricity consumption details for all the households in Langa, Guguletu and Khayelitsha were obtained from the relevant supply authorities. Second, a survey was carried out in 114 formal electrified houses in the three areas. Since Phase 4 was part of a longitudinal study, the previous formal, electrified household sample was used. The original sample was established on the basis of three criteria:

- *Electricity consumption levels* - houses in Khayelitsha were stratified according to low, medium and high consumption;
- *Spatial distribution and income levels* - the sample was distributed spatially in Khayelitsha between Town 1 and Town 2, the initial 'core houses' and the 'newer up-market' formal houses, in areas such as Bongweni and Jonkersdam;
- *Period of electrification* - a small sample of 30 houses (electrified for over twenty years) was chosen from Langa and Guguletu while the bulk of the formal electrified sample was drawn from the formal electrified houses in Khayelitsha. The rationale was to compare electricity use trends of newly electrified areas with areas that were electrified since the 1970s.

In an important departure, Phase 4 introduced an additional criteria; namely, settlement type (housing structure) in order to compare electricity consumption of formal electrified homes to that of recently electrified planned, informal households. Thus Phase 4 also surveyed 33 informal, recently electrified houses in Site B of Khayelitsha. While the core elements of the questionnaire used in Phase 3 were retained, some additional questions and approaches were introduced. These included, for example, introducing more open-ended questions and targeting the questionnaire at women in the household as they are usually the main users and managers of energy. For the first time, this Phase of the study employed only female fieldworkers. This was deliberate in order to ease communication with the mainly women respondents.

3. Electricity distribution

Electricity consumption patterns have to be understood in their particular political and socio-economic contexts. The Cape Town City Council (CCC), the official supplier of electricity to Langa and Guguletu is currently owed R60 million in electricity arrears, most of which was accumulated during the apartheid years. The CCC appears to have ignored the Western Cape government's cancellation of this debt and has embarked on a `vigorous disconnection programme' in addition to its ongoing campaign to install prepayment meters to recover arrears. Langa and Guguletu residents owe the CCC R22.6 million, an increase of R1.6 million since the Phase 3 report. The Council's trading surplus from electricity sales for 1993/1994 amounted to R70.5 million. Determined to collect the arrears, the CCC disconnected 4 800 houses in Langa and Guguletu between February 1994 and May 1995. By June 1995, 2 500 credit meters were replaced with prepayment meters, with residents in arrears being charged 14% extra on prepayment meter sales. So, although residents have access to electricity, there is much to discourage greater use of electricity and much to encourage residents to persist in multiple fuel use.

Phambili Nombane, a consortium of French, British and South African utilities, is now responsible for electrifying Khayelitsha. They aim to electrify 45 000 houses in Khayelitsha by December 1996 and, currently they are electrifying the informal houses in Site B and Site C. By October 1995, there were approximately 35 000 formal and informal electrified houses in Khayelitsha. Eskom reported that 30% of the electricity supplied to Khayelitsha (R800 000-worth of electricity per month) is consumed illegally. It remains to be seen whether this problem will threaten the electrification programme in the Western Cape.

Both Eskom and the Cape Town City Council have adopted a policy whereby all newly electrified homes will use a prepayment meters. The reason for introducing this is, first, to ensure that people pay up front for electricity and thereby prevent arrears build-up, and second, to make people aware of the cost of electricity to enable them to budget for electricity they use. Another advantage of the prepayment meter system is that electricity is made available in small amounts. The majority of respondents in the sample in Phase 4 have prepayment meters.

4. Electricity consumption

Chapter 4 of the report describes electricity consumption patterns in the three areas and also compares these with results from the previous phases of the study. Figures 1, 2 and 3 show the average household electricity consumption in Langa, Guguletu and Khayelitsha respectively.

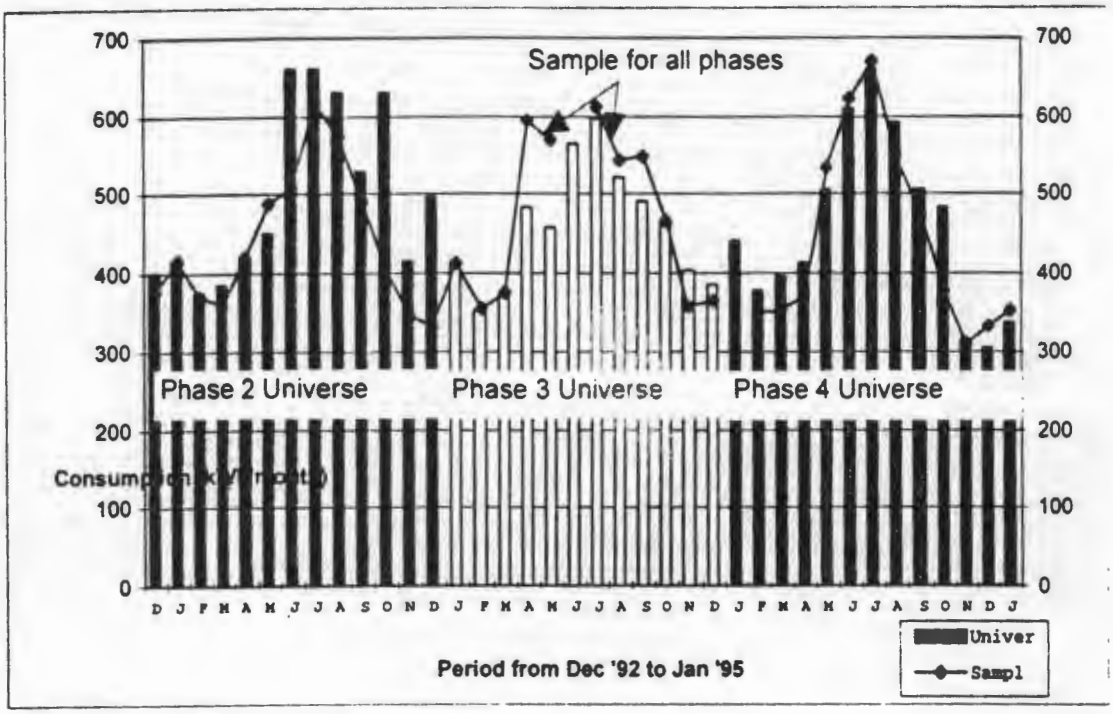

FIGURE 1: The average household electricity consumption in Langa for Phase 2-4 (1992, 1993, 1994)

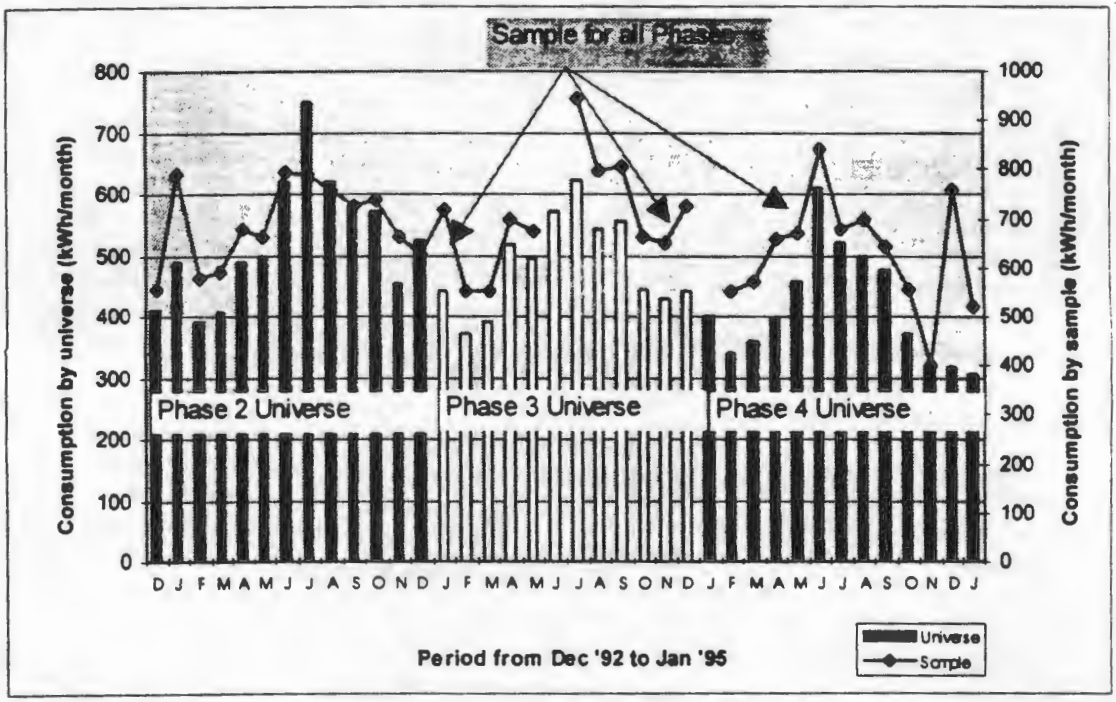

FIGURE 2 The average household electricity consumption in Guguletu for Phases 2-4 (1992,1993, 1994)

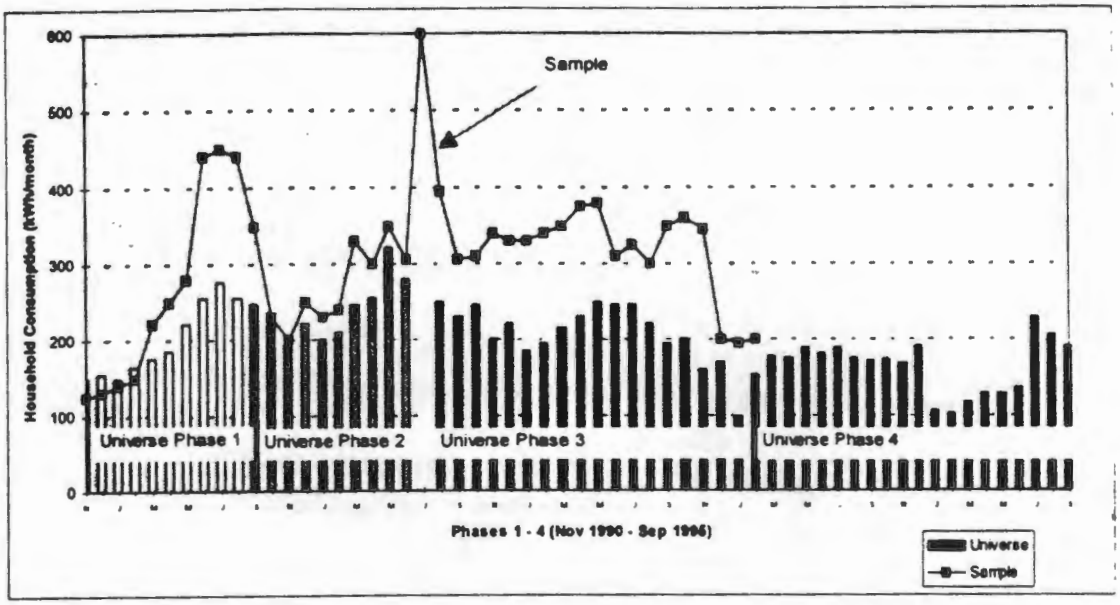

FIGURE 3 Average electricity consumption in Khayelitsha from Phase 1 to Phase 4

The cyclical rise and fall of both the sample and the universe according to the season is evident in all three areas and this highlights the fact that electricity consumption is influenced by the seasons. In Langa the average summer household electricity consumption recorded for Phase 4 (particularly between November and January 1994) ranged between 300 and 330 kWh/month and this was the lowest average consumption range recorded in the entire longitudinal study. A similar trend is evident for Guguletu. With regard to winter electricity consumption, Phase 1 reported a mean of 644 kWh/month for both Langa and Guguletu, which is consistent with the winter consumption range observed for the subsequent three phases in Langa. In Guguletu the winter peaks declined from 750 kWh/month in Phase 2 to 605 kWh/month in Phase 4.

In Khayelitsha, Figure 3 indicates a gradual increase in electricity consumption from Phase 1 to Phase 2. Consumption for Phase 3 remained fairly consistent with the previous phases but there was a marked decline in consumption during Phase 4 when consumption generally dropped below 200 kWh/month, the lowest recorded since the start of the study. Figure 3 also reveals that the overall electricity consumption throughout the four phases was below 300 kWh/month and in fact almost half of the formal electrified homes (47%) consume less than 140 kWh/month. Thus electricity consumption by Khayelitsha residents is far below that of Langa and Guguletu.

Thus in all three areas there is an overall decline in consumption over the duration of the study. With specific regard to Khayelitsha, the Phase 3 report attributed this decrease partly to the rapid increase in the number of households which were electrified over the period, coupled with the fact that newly connected households use lower quantities of electricity. A second factor causing the decline was given as the extent of theft (or meter faults) which reduced the average calculated household electricity consumption. These reasons would appear unchanged for Phase 4 as the number of connections continued to increase and also the problem of electricity theft remains unsolved. In Langa and Guguletu the decline in consumption can be attributed, in part, to the situation regarding arrears in payments, particularly over the last two phases. A consequence of these arrears was the introduction of prepayment meters which has had a downward influence on consumption and could be seen as an attempt by residents to save electricity. One further general factor encouraging this decline was the regularity of electricity supply breakdowns.

5. Energy services in formal houses

Chapter 5 examines which fuels and appliances are used by low-income electrified formal houses for cooking, water heating, lighting, entertainment, refrigeration and other end-uses. Figure 4 shows that electricity is used by the vast majority of households for media, lighting,

refrigeration and ironing. It is also used by the majority for cooking but lower proportions of the sample use it for water heating, space heating and laundry.

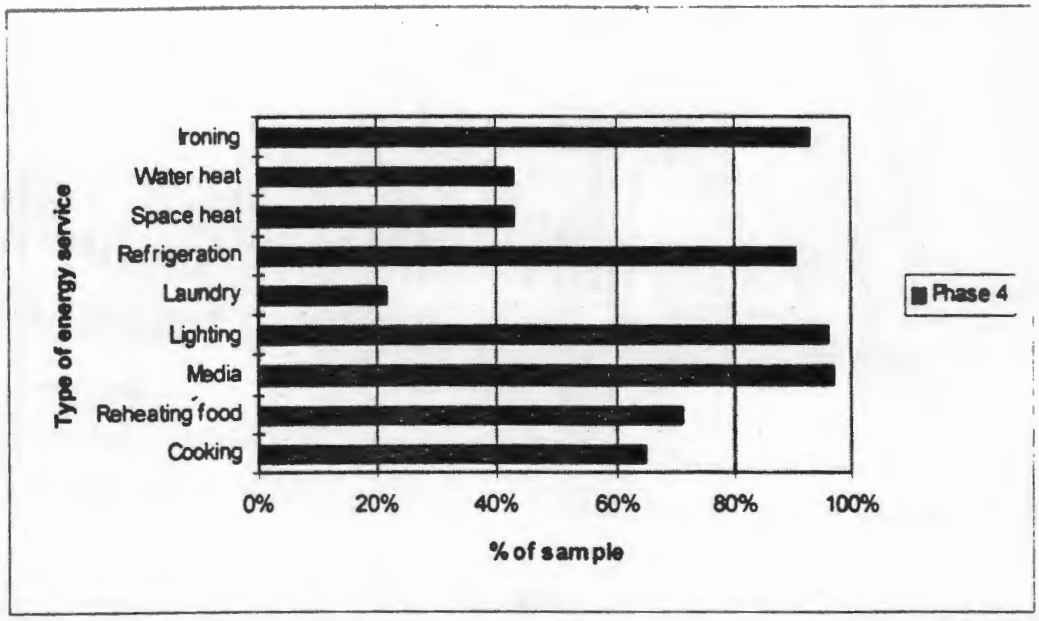

FIGURE 4 Domestic energy services for which electricity is used

With regard to cooking a range of fuels and associated appliances are used on a daily basis. These include electric hot-plates, electric 4-plate stoves, electric frying pans, gas stoves and paraffin stoves. In Khayelitsha the use of hot-plates has decreased over the four phases while there has been a steady increase in the use of 4-plate stoves. The picture in Langa and Guguletu is, however, somewhat different; the use of hot-plates appears to have remained constant but there has been a decrease in the use of 4-plate electric stoves over the five year period but a marked increase in the use of electric frying pans which are seen as being multi-purpose, convenient and as using less electricity than large stoves. Electric stoves are regarded as being clean, reliable, safe and quick. However, in general, users do not consider them cheap to operate.

Gas stoves are increasingly popular in Khayelitsha where the number of households using gas on a daily basis has increased from 20% in Phase 3 to 31% in Phase 4. Also, Phase 4 showed that over a third of respondents in Langa and Guguletu are using gas stoves for daily cooking. Respondents said that they used gas because it is reliable, cheap, clean and quick, although gas is considered dangerous by many users. Paraffin continues to be used in formal houses, mainly in Langa and Guguletu where the use of paraffin for cooking has increased steadily over the five year period with Phase 4 showing that 30% of households use primus stoves on a daily basis, up from 17% during Phase 3. In Khayelitsha, Phase 4 showed that very few households (only 4%) used paraffin for cooking. This figure was little changed from previous phases of the study. Paraffin is favoured by those who use it for being cheap, quick and a multi-purpose fuel.

In general the study shows a decline in ownership of all types of space heating appliances. One exception was in Khayelitsha, where Phase 3 reported a significant increase in the use of electric bar heaters, although Phase 4 results indicate a reversal of this trend. There has been a reduction in paraffin heating in both Khayelitsha and Langa/Guguletu. The use of gas heaters has stayed at a consistently low level in all three areas.

Phase 3 reported that electric geysers are utilised by a high proportion of Khayelitsha households (70%) while only a few have electric geysers in Langa and Guguletu (less than 10%). Phase 4 has produced confusing results regarding the use of electric geysers and shows the use of geysers declining from 80% to 45% of the total sample. Those households that do not use electric geysers, mainly utilise electric kettles or electric stoves, with about 10% of households using either gas or paraffin stoves.

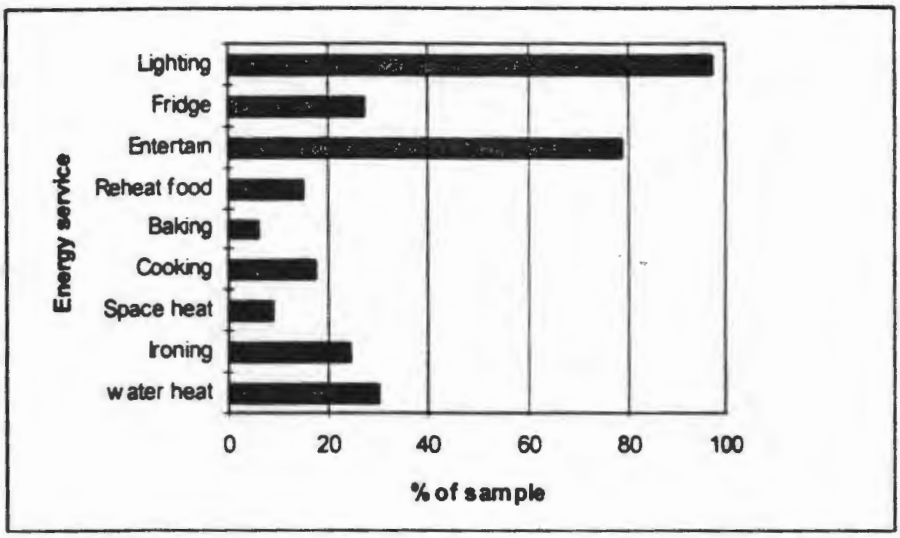

FIGURE 6 Use of electricity in informal houses

Only four households used electricity for all end-uses. Paraffin is used by 79% of the sample with only 18% using gas. Only one respondent used wood. Figure 7 shows expenditure on fuel and it is discernible that monthly expenditure on electricity is low with 45% spending less than R15 per month and a further 18% spending less than R25 per month.

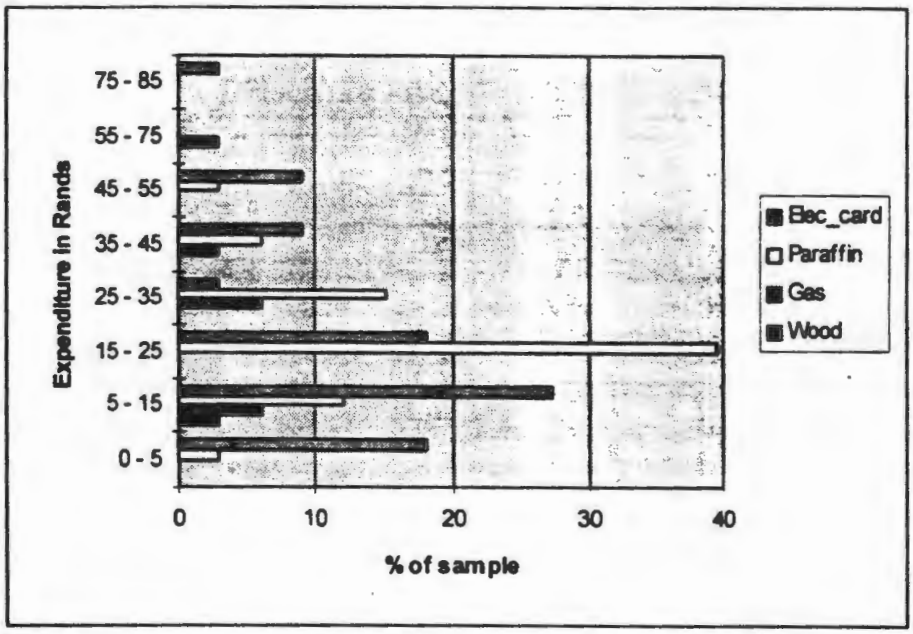

FIGURE 7 Monthly fuel expenditure in informal houses

7. Appliance acquisition in formal and informal houses

Energy end uses in low-income households cannot be understood without looking at patterns of appliance ownership, as the cost of appliances influences the type of fuel that is used. There are trends in appliance purchases that reflect the fact that few households can afford to buy new appliances. In general, economic constraints determine appliance and fuel combinations but the decision-making that governs fuel and appliance choice is also an important factor.

Mostly, only inexpensive appliances are purchased for cash. These include primus stoves, two-plate electric stoves, gas stoves, electric pans, irons, kettles and paraffin heaters, although some people use HP to buy these appliances. The larger more expensive appliances are

acquired mainly by purchasing second hand items for cash or on lay-bye, buying new appliances on lay-bye or through the use of HP. *Stokvels* or *umgalelo* (group saving schemes) are also used to finance the purchase of larger appliances. The majority of respondents bought their four-plate stoves on HP with a quarter buying them second hand for cash. Other appliances bought on HP include entertainment appliances, refrigerators and washing machines.

In the older, more established townships of Langa and Guguletu, people owned more 4-plate electric and paraffin stoves than in Khayelitsha. This situation is most likely linked to the fact that the two areas have been electrified very much longer than Khayelitsha and is indicative of increasing investment in electrical appliances with an increase in the period of access to electricity.

With regard to gender dynamics surrounding appliances acquisition and ownership, women are able to directly purchase appliances that are relatively affordable. However in informal households women have less freedom regarding such purchases. In most instances, decisions around purchasing kitchen appliances were taken jointly. The fact that decisions then are seldom made by women alone, although they are the primary users, reveals their limited access to resources and decision making in the nuclear family setting.

Appliance preference differed between formal and informal households and also between male and female respondents. Most appliances that people focused on were electrical with the exception of paraffin heaters. The most common first need in formal electrified houses were washing machines, followed by 4-plate stoves, entertainment facilities and microwave ovens. The most popular second priority appliance in formal houses included video recorders, electric frying pans, washing machines, vacuum cleaners and lastly, microwave ovens. In informal houses respondents saw 4-plate stoves as the first priority, followed by refrigerators and televisions. In both formal and informal houses approximately 10% of respondents said that they would pay cash for these appliances, while most respondents said they would utilise HP.

8. Main findings

- Electricity is seldom used to fulfill *all* energy services in both formal and informal electrified houses.
- Poverty shapes both fuel and appliance use to the extent that multiple fuel and appliances use are common strategies to conserve energy.
- Decision-making processes in the household is a 'gendered' phenomena and women do not necessarily use the appliance and fuel combination of their choice.
- Low-income households' energy and appliance choices are influenced by which fuels are accessible and affordable, which appliances they can afford, as well as by current perceptions of the electricity supply authorities.
- Determinants that shape fuel and appliance combinations differ between formal and informal households.

9. Policy recommendations

- The success of the electrification programme cannot be measured in isolation from other socio-economic and political considerations. The supply of electricity alone will not ensure that people use electricity but rather there are other important determinants of electricity use, a very important one being employment. The electrification programme appears to be driven by the need to meet RDP targets instead of being a people-centred process where the actual energy needs or 'demands' of the people are met. The provision of electricity will not automatically encourage poor households to switch to electricity, especially if other fuels are perceived to be less expensive, as is often the case, or if electrical appliances remain unaffordable. Thus domestic energy policy should not be geared simply to provide electricity, but also to meet the needs that stem from access to electricity.

- The electrification programme needs to be made transparent to ensure that people understand its objectives and to allow them to make effective and meaningful input into the process.
- A single domestic tariff is needed.
- In developed countries, multiple fuel use is a common and acceptable practice as a range of fuels are readily available, affordable and reliable, and the consumers are able to make informed choices regarding the fuels they use. However, multiple fuel use in the Western Cape, as in South Africa as a whole, is a legacy of apartheid and primarily a function of poverty. Low-income urban households are forced to rely on a variety of fuels for different purposes because of unreliable supplies, variable accessibility and high costs. Thus the electrification programme should be one component of integrated energy planning where all energy services are considered with regard to users needs, economic viability and environmental sustainability.
- Current energy appliance ownership and fuel use patterns do not always reflect women's energy needs but rather indicate accessibility. Policy makers therefore need to differentiate between what is construed as a 'demand' based on current fuel and appliance use and the actual demand by users.
- Domestic energy policies need to be gender sensitised by acknowledging that men and women have different roles and, therefore, different needs: energy poverty impacts on men and women in different ways. There are indications from the study that decision-making on appliance acquisition is a 'gendered' phenomenon. However more research is required to arrive at specific policy recommendations.
- There is a need to carefully consider the prepayment meter system. While there are many advantages associated with the present system some users complain that certain types of meter systems consume more electricity than others. One of the results is that Eskom continues to lose R800 000 per month in Khayelitsha alone as some users bypass the meters. This is apparently occurring throughout the country, and in the long term, could undermine the entire electrification programme. Electricity suppliers should ensure the prepayment card sale points are not only in residential areas but also where people work.
- Improvement in street lighting should become an integral part of the electrification programme.
- There appears to be great potential for small business and employment generation in appliance repairs.
- There is a need to alleviate and address the fears people have of using gas. At the same time policy needs to examine the gas chain more carefully and find ways to make gas more accessible.

10. Research recommendations

- Domestic energy policy research should be accorded greater importance by the DMEA.
- Further research needs to link gender and energy to understand the way gender dynamics affect fuel and appliance use. Such research warrants its own project as it is difficult to integrate these issues into studies with other primary objectives.
- The electrification of informal settlements, electricity consumption patterns and the end use patterns needs to be monitored carefully.
- More policy related, qualitative research at the household level is needed to inform policy.

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Introduction

The RDP is providing people with electricity but people do not have jobs to buy electricity.
– *Informal group discussion with women in Site B, Khayelitsha*

A focus on project implementation without beneficiary involvement in policy formulation is likely to make people's basic needs peripheral to the main thrust of policies, plans and programmes. An emphasis on policy decisions without popular involvement in implementation creates bureaucratic structures that do not truly reach people at the ground level. People and basic needs must enter at both the level of overall policy decisions and the level of actual implementation (Sen and Grown 1989: 41).

As a result of its growing international isolation under apartheid, the South African energy sector was supply- rather than demand-driven. In other words, energy policy was driven by the perceived need to achieve self-sufficiency rather than meeting the needs of the majority of the people. The legacy of this policy is that approximately 20 million black people currently have no access to electricity.[1] Eighteen months have elapsed since South Africa's first democratic election in April 1994 when the Government of National Unity (GNU) launched its Reconstruction and Development Programme (RDP). The RDP aims to redress the socio-economic imbalances inherited from apartheid and meet the basic needs of people. The main priorities include job creation, the provision of adequate water, education, and health services as well as building one million houses and electrifying 2.5 million homes over the next five years.

The Electricity Supply Commission (Eskom) of South Africa, the largest generator and distributor of electricity in Africa, is primarily responsible for the RDP's electrification programme. While Eskom aims to electrify 1.75 million homes between 1994 and 1999, the programme, in fact, began in 1990 and, by November 1995, Eskom had already electrified 835 000 homes (see *Prepayment Electricity*, July/August 1995:13; *Sunday Times*, 5/11/95). In Khayelitsha in the Western Cape, for example, Eskom has electrified 20 000 homes and these have been mainly in the informal 'site and service' or planned settlements.

It is widely accepted that the objectives of the electrification programme will be relatively easy to meet as South Africa has both a surplus of supply and a considerable infrastructural base. The critical issue, however, is to ensure that the programme is not driven purely by the need to meet RDP targets. Rather it should be a people-centered process whereby their needs are met and the quality of their lives are improved in real and meaningful ways.

Presently, low-income households throughout the country compromise their household energy needs as they are forced to depend primarily on dirty, unreliable, expensive, unhealthy and unsafe fuels. The dangers of this are manifest in the high incidence of paraffin poisoning amongst young children,[2] respiratory illnesses, burns, and loss of life and property. Moreover, approximately 24 million people are exposed to hazardous levels of air pollution resulting from their use of wood and coal (Terblanche et al 1994: 2). There are more than 600 electricity tariff rates undermining fairness and consistency.[3] Low-income households spend approximately 20% of their income on fuels (Eberhard 1990: 339) and, ironically, electricity is sometimes more expensive in poor black areas than it is in some affluent white suburbs.

Electricity supply to townships is unreliable, and poor people are forced to resort to using less convenient fuels in conjunction with relatively expensive and inefficient appliances. It is not

1 Black - refers to African, Coloured and Indian people.

2 16 000 cases of paraffin poisoning are reported each year (this is a conservative figure, some estimate poisonings to be as high as 48 000 (Paraffin Safety Indaba workshop held on 7th August in Cape Town). In 1990, a total of 436 children were treated for paraffin poisonings at six hospitals in the Cape Peninsula at a cost of R111 673 (De Wet et al 1994: 735).

3 This is currently being addressed by the newly-created National Electricity Regulator which seeks to make electricity pricing more transparent.

surprising that given the poor quality services to townships, in part a function of apartheid structures, many black communities remain suspicious of government structures and have developed a culture of non-payment for services. This has led to, amongst other things, the build up of massive arrears in payments for electricity services. In an agreement reached between the provincial governments and Eskom, Eskom has written off R1 billion worth of debts incurred before 28 February 1995 in an attempt to ensure that new local authorities would not have to service debts accumulated by previous unrepresentative councils (*Sunday Times*, 5/11/95). To redress the problem of non -payment of services, the GNU has embarked on the Masakhane Project – 'Let us build together' – which aims to improve services in townships, enhance the transparency of and participation in the policy– making process, reduce suspicion and thereby encourage residents to pay for services. However, despite the initial success of this project, service payments have declined and electricity arrears in November 1995 totalled R230 million. Eskom has warned that these arrears will slow down the RDP's electrification programme (*Sunday Times*, 5/11/95).

The project 'The Analysis of the New Urban Electrification Schemes in the Western Cape' began in 1991 and is currently in its fourth and final year. It aims to monitor and analyse the electrification programme in low-income households in the Western Cape. The overall objective is to inform urban energy policies in a manner which improves low-income household's access to electricity and other energy sources. The study was commissioned by the Department of Mineral and Energy Affairs (DMEA) and is one of the few longitudinal studies of this nature in South Africa. The current phase (Phase 4) of this study is similar to, and largely consistent with, previous phases. As the Energy and Development Research Centre's (EDRC) proposal explained, the objective is:

to examine electricity use in newly electrified areas, low income urban settlements by monitoring and analysing energy consumption data and relevant socio-economic information in the Western Cape. An important aim is to understand factors which affect the movement from multiple fuel use to greater electricity consumption. The intention is to provide more detailed information which will be of use to those involved with the electrification of these areas (1993).

Accordingly, the primary output will be to compile:

Information on bulk electricity and household energy consumption and key issues affecting the use of electricity and other fuels in low-income urban households which have recently gained or are in process of gaining access to electricity (EDRC 1994: 1)

In addition, the intermediate objectives of the study include:

- Measuring the overall electricity consumption patterns of three African townships in the Western Cape, namely Langa, Guguletu and Khayelitsha;
- Conducting a more detailed socio-economic study of formal electrified households in Langa, Guguletu and Khayelitsha that have been chosen on the basis of being high, medium and low electricity consumers as well as recently electrified households in informal planned settlements in Khayelitsha's Site B;
- Providing information on how decisions are made, and who makes them, with respect to energy use patterns and appliance use;
- Highlighting the determinants that shape decision-making around fuel and appliance ownership and use;
- Supplying information on determinants that affect electricity consumption patterns;
- Monitoring perceptions on energy services, billing, public lighting, meter systems and the Masizakhe Energy Centre (EDRC 1994).

An overarching concern is to explore the reasons why electrified households continue to engage in multiple fuel use. This continuing practice challenges the assumption that once households have access to electricity, they cease using 'traditional' fuels. The study also examines how people acquire appliances and the manner in which gender and power dimensions affect these decisions in both formal and informal houses. It is hoped that the new government's policy will increasingly reflect a more holistic, equitable, transparent and

gender-sensitive approach to the issues generated by the electrification programme. This study seeks to inform decision-makers of the impact of energy policies in low-income households to this end. At the same time, it seeks to facilitate interaction between policy-makers and end-users by making the policy-making process more participatory and interactive so that the electrification programme meets the *actual* energy needs of people.

1. Structure of the report

- *Chapter Two* provides a theoretical framework to help locate and interpret the research findings. It also outlines the methodology used, timing and problems encountered in this longitudinal study.
- *Chapter Three* provides an overview of the three areas namely Langa, Guguletu and Khayelitsha with a focus on electricity provision. In addition, it provides some background information on the sample.
- *Chapter Four* looks at the electricity consumption data of Langa, Guguletu and Khayelitsha for Phase 4 and compares the consumption details of Phase 4 to the previous three phases.
- *Chapter Five* looks at the way formal houses meet their energy needs, the determinants that shape their fuel and appliance decisions comparing it with previous phases;
- *Chapter Six* looks at the informal houses and how their needs are met, what are the determinants that shape their fuel and appliance decisions and how it differs from formal houses. This is a new dimension to the project.
- *Chapter Seven* examines the decision-making affecting fuel and appliance use, the way in which appliance are financed in formal houses and compares this with previous phases. It also looks at the priorities with regard to new appliances, barriers to purchasing new appliances and broken appliances.
- *Chapter Eight* examines perceptions on energy services including, billing, public lighting, different meter systems and the Masizakhe Energy Centre.
- *Chapter Nine* provides conclusions and recommendations for policy and further research.

Theory and methodology

> Energy is a highly technical field dominated by engineers, foresters, and energy planners – by definition. As the keepers of superior knowledge, it has been difficult for such professionals to elicit, acknowledge, use and respect people's traditional knowledge, including that of women. (Cecelski 1992: 8)

This study highlights the way in which low-income households fulfil their daily energy needs. It seeks to convey how energy poverty impacts on people's health, financial situation, security and safety, time and labour. However, to understand and interpret the findings of the study, it is necessary to locate it in a broader theoretical framework. Indeed, 'facts' are, in themselves, never value-free, objective or neutral but are given meaning through the theoretical concepts and normative frameworks that are employed by the researchers involved in the project. Bearing the problems of conventional research methodology in mind, the research approach tries as much as possible to make the respondents central to the study and allow their views to filter into the research so that it may impact on policy. The approach is based on the understanding that:

> development cannot be studied at all: we can participate in the processes that underlie development and observe, record and analyse what we see, but we can never be relevant to problems in the abstract. The key to being relevant lies in the participation of poor people in constructing our understanding of how their world operates. We cannot be relevant to people unless we understand their problems, but we cannot understand these problems unless people tell us about them. (Edwards 1994: 79)

The normative commitment in this study is explicit: that is, this research aims to discover ways to empower, involve and engage the individuals and communities that are supposed to benefit from domestic energy policies, including the electrification programme. This chapter is divided into two broad sections. The first delineates several key theoretical issues which inform and underpin the thinking of the entire study, while the section that follows outlines the methodology and research techniques that have been utilised.

2.1. Domestic[1] energy policy and research - from the 'periphery to core'

Energy is usually associated with large-scale, capital intensive technology projects run by experts to provide energy for 'economic growth' and it is usually considered to consist solely of inanimate fuels (Cecelski, 1992: 5). Although domestic energy plays an important role in society, domestic energy policy and research remains low on the policy agendas of developing countries. As a result, the needs of marginalised groups, such as women, are usually peripheral to the policy, planning and research of national energy programmes. As Cecelski (1992: 14) argues:

> most energy/environment research continues to have a technical or technoeconomic focus, so that there is an absence of location specific detail based on participation of target populations in problem identification and intervention section. Furthermore, the dearth of support for research on women, environment and energy in mainstream energy funding has meant that a number of energy issues, methodologies and technologies of crucial importance to women, go unresearched or under-researched because they do not fall within the definition of 'important ' sectoral issues.

1 Domestic energy refers to energy use associated with the household such as cooking, water heating, ironing, entertainment and space heating.

This bias is evident in South Africa's energy sector. Presently, 60% of South Africa's people do not have access to electricity. Despite the DMEA's stated commitment to the goals of the RDP, 68 percent of the budget for 1995/1996 has been allocated to nuclear energy, while the funds allocated to energy management and research programmes which could 'promote and ensure optimal utilisation of energy sources and which would contribute directly to meeting RDP objectives', received only 2.9 percent of the budget allocation (DMEA Parlimentary Explanatory Memorandum: 95). Domestic work often involves the human or 'animate' energy that is usually associated with 'women's work'. This work is not recognised in the formal economy, falls outside the scope of national accounts, and is, thus, granted little priority in national plans and programmes. In short, there is little recognition of the link between the work women do and domestic energy policy planning.

However, the growing number of women-headed households and the prevalence of women in the informal sector suggests that women are not only users, managers, and suppliers of energy but, increasingly, paying customers of energy services. Women are, moreover, primarily responsible for household work, including: cooking, laundry, ironing and heating water to bathe. The lack of affordable, efficient fuels and appliances makes these tasks more time consuming, labour intensive, onerous and dangerous. If energy planning and policy aims to improve the quality of people's lives in real ways, it needs firstly to re-prioritise budget allocations towards the domestic energy sector where it will have a more immediate and meaningful impact on people's lives. At the same time, it will need to focus squarely on addressing the needs of women by drawing them more closely into the policy planning and research process.

2.2. Electricity for *what?* and for *who?* A 'gendered' critique of current domestic energy policy

> The dream of the man in his shack is to have light. Just a light, a socket and a bulb that shines. (Pik Botha, Minister of Mineral and Energy Affairs 1995)

There are serious lacunae in the policy thinking that underpins energy policies in low-income urban areas in South Africa. To improve people's lives in meaningful ways, the electrification programme needs to be seen in more holistic terms and go beyond the narrow objective of simply electrifying 2.5 million households. Electrifying houses must not be seen as an end in itself but, rather, a *means* to fulfilling other basic needs. The provision of electricity will not automatically encourage poor households to switch to electricity, especially if other fuels are perceived to be less expensive – as is often the case – or if electrical appliances remain unaffordable. The lack of affordable appliances will reduce the potential benefits that could flow from improved access to electricity. While access to a light bulb may in some measure help to improve the quality of life, it will not necessarily reduce the problems associated with the use of other fuels, nor will it necessarily reduce overall household energy expenses. Clearly, it is important to address energy needs in a more integrated manner. Basing domestic policies on how much electricity is consumed and how much people spend on electricity in isolation from wider socio-economic contexts will not contribute to meeting people's priorities and needs.

Current thinking around energy policy is also gender-blind. It tends to overlook the differing energy needs and interests that emerge within the household. In the above quote, the Minister makes no mention of which electrical appliances a woman might want in *her* shack to complete *her* dream. It is unlikely that the electrification process, as it is currently geared, would signal an immediate improvement in the quality of life for *all* members of a household as men and women in the household experience the benefits and costs of energy in 'gendered' ways. Current domestic policies ignore the fact that the most energy and labour intensive activities in the household are generally performed by women. Women would benefit from the electrification programme if it encouraged or facilitated greater use of electric stoves, kettles, irons and refrigerators which make their work easier. So long as appliances remain unaffordable, the full benefits of electricity will remain unfulfilled.

The basic needs approach assumes that everyone within the household has the same needs and that deprivation impacts on all people in the same way. In most instances, however, poverty affects men and women, girls and boys, and the aged, differently. Being the ones primarily exposed to cooking in poorly ventilated areas - with poor quality, dirty fuels - women and children suffer most from respiratory illnesses.

Energy poverty also affects the nutrition in households. Foods that might be nutritious, but time and energy consuming, are substituted with meals that can be prepared quickly and with less fuel. In other cases, food is under-cooked or served cold to conserve fuel. The costs of fuel and appliance also determines what food is prepared and how, and dangers are largely overlooked. The lack of refrigeration dictates the type of food that people consume and this, in turn, has implications for health. The time and effort that goes into finding ways to conserve fuel and compensate for energy poverty also limits women's leisure time and the time spent with families. Energy poverty is all encompassing and women, as the household's resource managers, are continually forced to weigh the costs of food against the cost of fuel and appliance use.

Sen and Grown (1987: 23) argue that `women's work, underrenumerated and undervalued as it is, is vital to the survival and ongoing reproduction of human beings in all societies. In food production and food processing, in responsibility for fuel, water, health care, child-rearing, sanitation, and the entire range of so-called basic needs, women's labour is dominant'. Household resource managers, usually women, confront the difficulties and challenges that result from energy poverty. In this context, it is women's needs and interests that should be central to defining what constitutes the basic needs of people. While gender-sensitive domestic energy policies could make an immediate improvement in women's lives, it is important to recognise that women do not constitute a homogenous category; their needs and interests are shaped by other factors such as their class, race, and culture. Therefore, effective policy planning for women in low-income communities needs to be context-specific and consultative.

For domestic energy policy to be effective, both the research and the policies need to go beyond the household as a unit of analysis and uncover the dynamics of household decision making:

> the household can neither decide nor think, since analytical constructs are not so empowered. Rather certain people within the household make decisions. One or more persons with enough power to implement them makes decisions and other less empowered household members follow them. (Wolf, in Kabeer 1991: 120).

Little research has been conducted in South Africa around household decision-making that governs fuel and appliance ownership and use in households. Due to various limitations, this study used quantitative research approach to uncover the gender dynamics impacting on fuel and appliance use. This approach was inadequate and in future, research needs to be strengthened with qualitative research methodology. According to Kabeer (1991: 14),

> Quantitative approaches may be able to capture some of the outcomes of unequal power, they may ... even measure 'statistically important' areas of decision making power for women and men. But power is far more elusive phenomenon than these forms of data can depict. Its elusiveness lies precisely in its resistance to 'objective' observation.

It should be clear to policy makers and analysts that access to and control over resources and decision-making is not unproblematic. Households are, in reality, a site of potential conflict and decisions should be seen as a `function of the relative bargaining power of it's members' (Kabeer 1991: 120). Thus, according to Sen (in Kabeer 1991: 120),

> The prosperity of the household depends on the totality of various activities - getting money from incomes, purchasing or directly producing food, materials ands other goods, producing edible food out of food materials, and so on ... the members of the household face two different types of problems simultaneously, one involves co-operation (adding to total availabilities) and the other conflict (dividing the total availabilities amongst the members of the household).

Decision making over household resources are likely to be influenced by gender. For example, a study conducted in Zambia found that:

> Men buy larger, costlier appliances whereas women control money for smaller routine items. What the spouses buy reflect power and control over resources. Even when women have an independent income, husband's try to exert control over how the wife's income is used. There is a tendency for him to spend less on the household if the wife is earning an income (quoted in Chiwele et al 1994: 6).

This division of responsibilty is likely to apply to decision making around fuel and appliance use. Policy makers therefore need to realise that what is construed as a 'demand' in terms of current fuel and appliance usage in projections for energy planning does not necessarily mirror the *actual* demand regarding energy needs.

2.3. The 'transitional fuel model' versus the practice of multiple fuel use

A primary consideration of this study is to explain why low-income electrified households, some of which have been electrified for over twenty years, continue to use other, more 'traditional' fuels. The answers to the question `why do people engage in multiple fuel use?' are not as straightforward as one might expect. Revealing a rather linear conception, the 'domestic energy transition model' assumes that poor people will follow a natural progression from using traditional fuels such as biomass to gas and paraffin and to the final and complete dependence on electricity once the latter becomes accessible (Viljoen 1990: v). The use of traditional fuels is seen as evidence of `backwardness'. There are serious flaws in this conception. In the first place, by promoting electricity, the transitional model may encourage practices that contribute to environmental degradation. Already, Eskom's coal-fired power stations generate 95% of South Africa's electricity, emit 217 tons of carbon dioxide annually (or 78% of South Africa's energy related carbon dioxide emissions) and one third of Africa's total carbon dioxide emissions.

Moreover, a cursory empirical examination of households' fuel use patterns in industrialised countries contradicts the assumptions of the transitional model. In developed countries, multiple fuel use is a common and acceptable practice as a range of fuels are readily available, affordable and reliable. Consumers are able to make informed choices in the fuels they use. Of course, the situation in developing countries is different; multiple fuel use is primarily a function of poverty. Low-income urban households are forced to rely on a variety of fuels for different purposes due to unreliable supplies, variable accessibility and expense. There are a range of complex, tangled and diverse factors that shape fuel use and, the use of appliances.[2] For example, Annecke (1993: 51) demonstrates that domestic fuel use is not determined solely by household income or fuel price but also by the way women perceive their roles as 'mothers' and providers. In this example, women sometimes choose to make bread even though this is more expensive than the cost of a standard loaf of bread.

One cannot examine the determinants of fuel use in South Africa today without reference to the legacy of apartheid. Sixty percent of the population were denied access to electricity and were forced to depend on alternate fuels. In Gauteng, for instance, most electrified households in the townships continue to use coal stoves to meet their daily energy needs. This may be explained by

2 Some of the important determinants of fuel use include `household size, household structure; tenurial rights; water supply type; household income (including patterns and reliability); expenditure on all household requirements; status (gender, age and education) of fuel and appliance user; extraordinary energy use; preferences; home based productive activities; health and safety considerations; fuel prices; availability of and access to energy carriers; reliability of supply and uniformity of quality; cost of access to energy carrier, appliances -source, cost, length and ownership; technical and economic characteristics of appliance-fuel combination (convenience of use, multiple end-use)'. (For a more detailed list see Williams 1993: 10).

personal preference, entrenched behavior, the existence of readily accessible and relatively cheap coal supplies, investment in coal stoves and the high cost of purchasing a new, electric stoves.

Low-income households seldom depend on a single fuel to meet all their household needs. Multiple fuel use presents policy makers with an opportunity to promote a range of fuels rather than exclusive dependence on electricity. In the context of scarce government resources this more flexible approach could prove feasible. The challenge should be to find ways to make a range of fuels more reliable, accessible, and affordable and, at the same time, find ways to reduce the negative impact they might have on the environment.

2.4. Phase 4's methodology

As in previous phases, there are two primary sources of information.

- The electricity consumption details for Langa, Guguletu and Khayelitsha. The Cape Town City Council (CCC) provided a monthly breakdown of the electricity consumption details from January 1994 to January 1995 for all 10 816 customers in Langa and Guguletu. Phambili Nombane[3] provided the consumption details for Khayelitsha residents over the same period. As in the case of Langa and Guguletu, the customer base is split along credit and pre-payment meter systems. The consumption data for both formal and informal houses in Khayelitsha were requested.
- A survey was carried out amongst 114 formal electrified houses in Langa, Guguletu and Khayelitsha and 33 informal, recently electrified houses in Site B, Khayelitsha.

Since Phase 4 is part of a longitudinal study, the previous formal, electrified household sample was used. The original sample was established on the basis of three criteria:

- *Electricity consumption levels* – houses in Khayelisha were stratified according to low, medium and high consumption;
- *Spatial distribution and income levels* – the sample was distributed spatially in Khayelitsha between Town 1 and Town 2, the initial 'core houses' and the 'newer up-market' formal houses, in areas such as Bongweni and Jonkersdam.
- *Period of electrification* – A small sample of 30 houses (electrified for over twenty years) was chosen from Langa and Guguletu The bulk of the formal electrified sample was drawn from the formal electrified houses in Khayelitsha. The rationale was to compare the electricity trends of newly electrified with areas that were electrified since the 1970s.

Phase 4 introduced an additional criteria; namely the settlement type (housing structure) in order to compare electricity consumption of formal electrified homes to that of recently electrified planned, informal households.

Phase 4's project proposal stated that informal planned electrified households from both Site B and Site C would be included. However, the sample had to be confined to Site B since Site C had not been electrified at the time of fieldwork. Phambili Nombane has electrified 3 000 households in Site B and the names and addresses of their clients are captured on their data-base. Every 100th customer from their list of 3 000 customers was chosen for the sample. An additional three houses were included in the sample bringing the total to 33 houses interviewed in the informal electrified area.

3 Phambili Nombane, meaning 'Forward with Electricity', is a company of three partners, namely Eskom, Electricite de France (EDF) and East Midlands Electricity (EME) that took over from Lingeletu West Council in 1994.

2.4.1 The differences between Phase 4 and previous phases

- Whereas the previous phases analysed formal electrified households, Phase 4 included a sample of 33 recently electrified houses from an informal planned settlement in Khayelitsha. This permitted comparisons to be made between formal and informal houses in terms of patterns of appliance ownership and the determinants that influenced fuel use.
- While the core questions of the previous questionnaire were retained in Phase 4 questionnaire, the various end use functions such as cooking and reheating food, water heating, entertainment, issues around laundry, refrigeration, space heating were elaborated on more fully. In examining energy end-use services, questions about who was responsible for carrying out domestic tasks was introduced to establish the gender division of labour.
- In a departure from earlier phases, Phase 4 attempted to highlight the gender dynamics that influence energy decisions and appliance ownership in low income households, since women are the primary users, managers and clients of energy services at the household level. Ideally gender issues should have been integrated into this longitudinal study from its outset. While it is important to incorporate these concerns even at this stage, the consequences is that these concerns may have been addressed superficially in so far as gender questions were 'added on' to the existing core questionnaire.
- Whereas previous phases examined the overall acquisition of appliances to fulfill energy services, Phase 4 examined how these *different* appliances were acquired.
- In order to provide a more accurate assessment of energy use and decision making in all 146 households, questions around the decisions to acquire appliances were included. While some trends were recognized, it became obvious that decision-making on these issues is a complex process that requires more sophisticated, qualitative research methods and tools.
- The questionnaire in the previous phases was directed at the `household head'. In general this term is associated with a conventional understanding of the nuclear family where the man is usually viewed as the primary breadwinner and key decision maker. This is clearly inappropriate as there are a variety of household types that include a woman-headed household, a house shared by a brother and sister, and households comprising of extended families. The original question was therefore omitted and, instead, the individual's contribution to the household was explored.
- Previous phases examined the determinants of electricity consumption in terms of, amongst other things, household size, appliance use, period of access. In most instances, the findings were similar to earlier phases.
- A question to determine the priorities of residents formal and informal settlements with regard to housing, education, employment and electricity was also introduced.
- To enhance the qualitative dimensions of the study, several open-ended questions were included in the questionnaire. These attempt to understand for example, why households use a particular fuel and appliance combination to cook particular dishes and whether specific appliances are used because they are multi-purposeful.
- Accessibility of fuels such as gas, paraffin and electricity prepayment card depots were assessed.
- End-users opinions regarding the installation of pre-payment meters as opposed to the credit meter, public lighting and billing were explored.
- The questionnaire tried to assess the penetration of paraffin safety caps in the three townships being studied. The caps, together with instruction leaf and stickers donated by British Petroleum (BP), were given to respondents. A possible follow-up study might assess the utility of these caps: are they being used and do they help deter paraffin poisonings?

2.4.2 Timing of the study

The research project began in September 1994 and a great deal of time was spent revising the original questionnaire and attempting to integrate the new dimensions of the study. Following the pilot study of six households in the sample, the questionnaire was revised. Sections of the Phase Three's questionnaire had to be redesigned and rephrased. Bearing in mind the language barrier, it was important for the accuracy of the research that the questions were clear so that they did not lose their meaning when translated into Xhosa. Ms Debbie Hene was instrumental in this regard. While some of the original questions were difficult to translate, they had to be retained as they formed part of the core. Similarly, as Phase Four was part of an ongoing longitudinal study, it was impossible to change the approach drastically; the more modest aim was to enrich the research findings.

New fieldworkers had to be trained. Initially one research assistant, Ms Hene, was drawn into the project but a second woman, Ms Nosibele Ngedele, had to be employed to speed up the fieldwork. The bulk of the research was conducted between November 1994 and March 1995. It was difficult to conduct surveys in December – January festive period as many respondents were away visiting families. It was difficult to find people at home during the day and appointments had to be set up in the evenings and over weekends. Also, two of the respondents from the core sample had moved house, and one was in the process of moving. The reasons people gave for moving is that they felt unsafe in the area or they wanted a bigger house. Ten of the respondents either refused to participate in the study or were difficult to contact. Such problems are inevitable in longitudinal studies and, as in previous phases, new households had to be included to complete the sample.

The consumption details from the different authorities had to be secured, analysed and compared to the previous phases. There were delays in obtaining the electricity consumption details from Phambili Nombane for Khayelitsha which resulted in a delay in the project report. Instead the data for formal electrified households in Khayelitsha was ony received at the end of October 1995. The electricity consumption details for Langa and Guguletu were received in May 1995 from the CCC. Initially, the CCC resisted disclosing the specific electricity consumption details as it might be construed as a breach of confidentiality but in July 1995 they provided the overall monthly consumption details of all 30 respondents without attaching any names to them.

Since the questionnaire had not been coded before hand, the manual coding of the 147 questionnaires during the project proved time consuming. The data was then captured on the PUNCH data base designed by Data Research Africa. Thereafter the data was verified and analysed mainly by Mr. Geoffrey Letsoalo.

2.4.3 Problems encountered in Phase 4

There is evidence that progress has been made in understanding low-income household's fuel usage patterns from Phase 1 to Phase 4 of the study. Nevertheless, certain problems and inconsistencies impacted on the findings of Phase 4 and made the summing up of the entire project difficult. More positively, these difficulties may offer guidelines for future longitudinal research.

The first difficulty arose from a lack of continuity in the project in terms of personnel, approach and methodology. This undermined teamwork and restricted researchers from becoming intimately involved in the study and taking ownership of it. The lack of continuity also diminished the rapport between researchers, fieldworkers and respondents that is essential for qualitative and interactive research. In the past, respondents were often peripheral to the research project and they were not consulted with nor informed on the findings. This bred apathy and declining interest amongst respondents. Incentives (gifts) had been given out in previous phases and led to high expectations and disappointments when Phase 4 was unable to do the same.

Project leaders for each phase had different training, academic backgrounds and outlook. This undermined consistency with regard to how the research was approached. The methodology did

not allow for a more detailed and intimate understanding of the household and the use of energy in this context.

According to the proposal for Phase 4 (1994), one of the enabling outputs included providing information on:

> how decisions are made concerning the fulfilment of household energy services. Provide insights into who makes the decisions concerning energy services (meaning the combination of appliance and fuel) and why those particular decisions are made. Provide an understanding of what are the determinants that shape decision making around fuel use (including seasonal variations, and energy policy changes) and appliance ownership and use. The information will be analysed from a gender perspective focusing particularly on women.

On reflection, the stated outputs of the proposal were too ambitious. Gender and power dynamics affecting appliance and fuel use is a new and important area of domestic energy policy research which requires further and separate research. So although gender issues emerging from this study are discussed (from a theoretical perspective as well as issues emerging from the research), the main objectives of the longitudinal study – to provide bulk information on consumption data and relevant socio-economic information – were adhered to.

It was argued that in order to ascertain the reasons for multiple fuel use, the main energy users at the household had to be targeted. Since women are the primary users and managers of energy at the household level, they were targeted in the study. (However, future gender and energy policy research should target the household energy needs and interests of *both* men and women).

As the sex of the researcher was considered important in the collection of data and putting the female respondents at ease, women interviewers were employed. According to Moser (1993: 97)

> The assumption that data are objective and 'value-free' is particularly problematic for a planning tradition concerned with transformation, and the redistribution of power and resources within society. So much of the bias in the data collection has been the result of the very biases of researchers. This makes it important for women to participate in the collection of data concerned with gender issues, for the manner in which questions are asked, and the sex of the researcher can decide research outcomes.

This type of sensitivity is vital to the research. For example, in the previous phase one female respondent was assaulted by her jealous husband who accused her of having boyfriends who came to their house during his absence and exchanged gifts with her. According to Mrs. X,

> I nearly died for participating in a research that I did not even know what it was going to do for me ... when you came here the day we made an appointment, my husband was here. I was happy that he was present to hear the explanation that you gave for this research. I was particularly happy that you were a woman and also liked it when you reminded us of some of your people from the team who must have been here to conduct the research.[4]

The fact that authorities responsible for electrifying Khayelitsha kept changing caused problems and delays in securing information. Furthermore, the information gathered for the earlier phases of the study had not been stored on a common data base, neither were the same analysts and computer packages used to analyse the data which led to duplication and inconsistencies. It was also difficult to secure some of the data from the previous phases.

The fact that the funding for this project was renewed on an annual basis did not facilitate the development for long-term vision and objective, nor did this encourage capacity building that is required for a systematic study. This is partially the result of the wider problem relating to the value and priority accorded to domestic energy policy research.

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4 Debbie Hene's fieldnotes

The objectives of earlier phases were narrow and it was possible to complete the project within the twelve month time frame. However, although each year new approaches and objectives were incorporated into the project proposal, the time frame was not adjusted. By the fourth phase, the project objectives had expanded and included examining energy consumption patterns, and analysing socio-economic details of newly electrified informal houses. In addition, one of the aims of Phase 4 was to introduce qualitative research techniques. Due to time constraints and in order to fulfil the requirements of Phase 4's objectives, open-ended questions were introduced into the study and a focus group discussion held with the women in the informal settlement.

An overview of Langa, Guguletu and Khayelitsha

> Problems are usually specific in their complexity to a particular time and place. (Edwards 1994: 78).

This longitudinal study examined the use of energy – particularly electricity – in low-income formal and informal houses in areas in Langa, Guguletu and Khayelitsha: three African townships in the greater Cape Town area. Earlier project reports provide a comprehensive historical background of these three areas.[1] This chapter focuses on some issues that might help explain electricity consumption patterns. It is divided into two sections. The first section provides a brief overview of Langa, Guguletu and Khayelitsha. Electricity consumption in these three areas is discussed in the context of the overall energy consumption and climatic conditions in the Western Cape, electricity arrears (the suppliers policy regarding arrears) and the types of meters installed. The second section introduces the research sample and provides information regarding the housing type, age and gender of respondents, and tenure, for example.

In the Western Cape, households primarily use paraffin (60%), followed by electricity (41%), liquefied paraffin gas (24%) and coal (4%) (Williams 1994: 11). Energy consumption patterns are partially dependent on the climate which may be described as temperate, Mediterranean-type where the summers are hot and winters are wet and rainy. Energy consumption trends are likely to change as the electrification programme currently underway gains momentum. It is nevertheless unlikely that electricity will completely replace other fuels in low-income households. The location of the three areas studied, namely Langa, Guguletu and Khayelitsha, is shown in Figure 3.1.

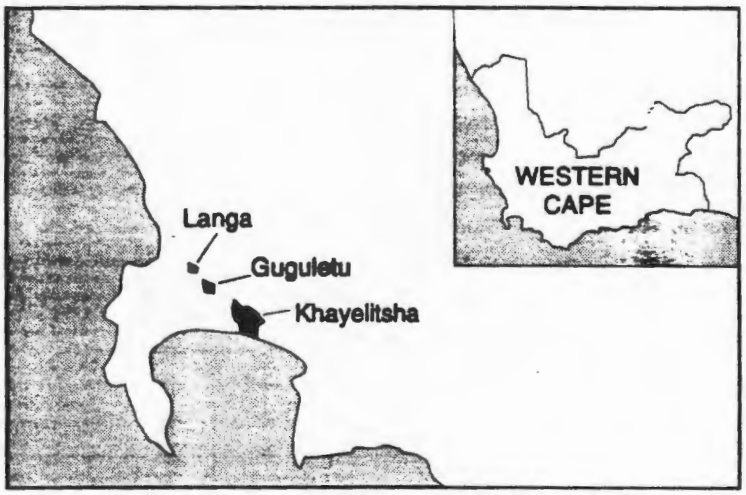

FIGURE 3.1 Low income areas studied in the Western Cape

3.1. The politics of power: the context of electricity consumption in Langa, Guguletu and Khayelitsha

During the apartheid era, electricity was one of the few services to which *some* Black people had access. It is therefore not surprising that different strategies – including illegal – were employed to maintain access when supplies were threatened. Residents also engaged in the 'on selling' of electricity (illegal electricity connections) and this continues amongst backyard

1 See Theron, P 'An Analysis of New Urban Electrification Schemes in the Western Cape – Phase I', Chapter 2; Thorne, S and Theron, P 'An Analysis of New Urban Electrification Schemes in the Western Cape – Phase II', Chapter 2; and Thorne, S and Qangule, V 'An Analysis of New Urban Electrification Schemes in the Western Cape – Phase II', Chapter 2.

shack dwellers in Langa and Guguletu. Moreover, prior to the democratic elections in April 1994, Langa and Guguletu were 'no go areas' for the Cape Town City Council (CCC) electrical department personnel.[2] In fact, personnel have only recently been able to enter Langa and Guguletu to maintain and upgrade electrical structures. Frequently, when residents were disconnected for not paying their electricity arrears, they simply reconnected themselves.[3] Other residents in Khayelitsha's formal houses resorted to 'stealing' electricity by tampering with prepayment meters, a strategy which proved costly to Eskom. The fact that some residents (especially the formal houses in Khayelitsha) were stealing electricity may have also affected the official quantity of electricity that people consume.

One of the objectives in this study is to determine why households that have had access to electricity for over twenty years continue to engage in multiple fuel use. Several considerations appear pertinent. Multiple fuel use, particularly in Langa and Guguletu, may have been part of a strategy by residents in arrears to save electricity. Further, the prepayment meters which were installed when Khayelitsha was established and which have been recently introduced to Langa and Guguletu, may have also encouraged the use of cheaper fuels as the meters clearly reveal the relative costs attached to different energy end uses.

3.1.1 Power to the poor? - The case of Langa and Guguletu

This section provides some background information on the CCC which is the official supplier of electricity to Langa and Guguletu. The CCC buys most of its electricity in bulk from Eskom. Under apartheid, White Local Authorities (WLA) used the surpluses made by electricity sales to subsidise property rates. In 1992, Cape Town reportedly made a surplus of R92 571 000 usually used for public lighting, traffic lights, electricity supply to other departments, and rental of land for other departments (Steyn 1993: 9). The CCC continues to cross-subsidise property rates in white suburbs, while electricity services to townships remain underdeveloped and of poor quality: 'This low level, racially-fragmented political control has ensured that resources that would enable electrification in poorer black areas, such as surplus value and the ability to raise capital, are locked in the wealthier areas that are fully electrified' (Steyn 1993: 8).

According to the City Electrical Engineer's Statement for the financial year of 1993/1994, income from the sale of electricity increased by 10% to a total of R671 million. The single largest sector consuming electricity is the domestic consumer base of 237 538 customers who account for 46% of the total consumption. The Electricity Department received R671 182 55 from the sale of electricity, R10 819 102 from other sources, R37 503 168 from the Appropriation from the Tariff Stabilisation Fund and Capital Development Fund. In terms of its expenses, R361 647 297 worth of electricity was purchased from Eskom, the fuel for the Council's power stations (R401 237), capital charges (R82 115 975), salaries and wages (R107 157 959) and other (R59 717 157). The gross revenue for the year equaled R719.5 million of which R70.5 million (the total trading surplus) contributed to the relief of rates, representing 10.5% of the income from the sale of electricity (*Annual Report of the City Electrical Engineer*, 1993/1994).

Currently, the CCC is owed R60 million in electricity arrears, most of which was accumulated during the apartheid years. The Western Cape government's recent cancellation of debt amounting to R300 million has been criticised by the CCC. They argued that 'When we are owed money it is recoverable and we will do everything in our power to recover it. We spend money on electricity and we expect to recover it. Until we see hard cash we don't regard it as written off' (*Prepayment Electricity* July/August 1995). The CCC seems unpeturbed by the governments cancellation of the debt and has embarked on a 'vigorous disconnection programme' as well as a campaign to install prepayment meters to recover arrears. The CCC has introduced a 14% surcharge on all customers who have switched to the vending systems

2 According to the CCC , the poor quality of electricity supply in Langa and Guguletu was a result of high consumer densities and peak hour loading. The depot personnel were unable to rectify this in the past and it was only after the elections that they were able to upgrade and improve the system (City Electrical Engineers Annual Report 1993/1994: 12).

3 The CCC then made the disconnections through the supply cable. The personnel responsible had to be accompanied by a security squad to ensure their safety, Ibid. 11

and who are in arrears until such time that the arrears are paid up (*Prepayment Electricity* March /April 1995: 11).

In 1993, the CCC introduced a programme to install 100 000 electricity prepayment meters over the next five years. It targeted domestic users as its priority. Thus far, the CCC has installed over 50 000 units; an average of 250 units are installed on a daily basis (*Prepayment Electricity* March/April 1995: 11). The programme aims to ensure that people do not rely on credit but pay cash-up front for the electricity they consume. This strategy aims to recoup arrears and has been described as `an outstanding success'. An estimate of R500 000 is being recovered by the CCC each month (*Argus* 10/11/95).

There is some confusion arising out of the CCC co-chairperson statement `that every time the consumer (those in arrears) bought a card to use in the dispenser, 14% of the cost went towards paying the arrears' (*Argus* 11/10/95). The question is the 14% surcharge on the electricity consumed, or is the cost added onto the price charged to consumers, or is 14% of the cost of electricity that consumers buy going towards arrears? This may confuse consumers over what exactly they are paying for. To compound the problem, the inclusion of a surcharge occurs at a time when there is a concerted effort to standardise the rates charged for electricity, and the CCC's 14% surcharge may in fact be perpetuating an unequal tariff system. Finally, the policies serve to obscure debt repayment by consumers who must rely on the good faith of the CCC to indicate exactly when their debt has been paid up. The coupon and card system provides no clear indication of when the arrears are paid up.

Residents appear unaware of the fact that they are paying a 14% surcharge on the electricity tariff. They seem to be under the impression that their debts are automatically canceled when their credit meter are replaced with a pre-payment meter.

The questionnaire in Phase 4 inquired about the replacement of credit meters with prepayment meters. While some respondents voiced outrage and stated that they would want to be reimbursed for the installation costs of the credit meter, others asked questions about why this policy is only being implemented in the townships.

> If Eskom changes electricity to the card system our installation fees should be brought [given] back.. Eskom is very tricky and has been estimating our units for a long time. Now [we] end up with high unbelievable bills – I am fed up.
>
> Eskom should not force everybody to have a card system – we paid for our electricity installation and manage to pay. I do not want the card electricity – I am a heavy asthmatic. [The] Card takes a lot of electricity many people do not even use their stoves because it (the units) go very quickly with the card system.. People end up supplementing with other fuels – gas and paraffin.
>
> It is pure apartheid – I have never seen a white person/family with a card – yet they use electricity for everything that they have, that is, swimming pools, lawn mowers ... but at the end of the month they pay R200 only – same as us. We don't even have electric geysers.

Clearly it is going to take a long time to win the trust of the domestic consumers and the current confusion and lack of transparency will do little to improve relations between residents and CCC.

3.1.2 Background Information on Langa and Guguletu

Both Langa and Guguletu are representative of the 'older generation' of poor areas in the Western Cape (Thorne & Theron 1993: 5). Both are located in the Cape Flats. Langa, situated 10 kilometers from the centre of Cape Town, was developed as a 'model township' for African people in 1922. Langa has 3 120 formal houses, 2 735 informal structures and hostels that sleep 9 500 people (Dodson & Dewar 1991: Appendix 5). Initially, accommodation in Langa and Guguletu was provided on a temporary basis in the form of hostels and small, box-like houses. These houses – called `NE51/9' – were three-roomed serviced by cold running water but had no ceilings, internal doors, internal plastering, or kitchen sink (Thorne & Qangule 1994: 7). The lack of insulation meant that people, if they can afford it, must consume more heat, especially during cold weather. Initially, these were rentals but, in the early 1990s, the state turned over ownership to people who had been renting for more than 10 years.

The renting of shacks in backyards has become a lucrative business and it is not unusual for owners of formal houses to have up to ten shacks on their property. The backyard shacks in Langa and Guguletu are said to accommodate about 11 500 people (Dodson & Dewar 1991: Appendix 5). Eskom's policy on backyard shacks varies from province to province. While there is no formal provision of electricity to backyard shacks in the Western Cape, the 'on-selling' of electricity to backyard shacks contributes to the high household electricity consumption levels recorded in Langa. The electrification of backyard shacks is controversial as these structures do not have water or sanitation facilities and electrifying these might be seen as an acceptance of the *status quo*.

Population estimates for Langa vary significantly. According to the Cape Provincial Administration (CPA) Langa has a population of 65 700, while other studies estimate it to be in the region of 75 700 (Dodson & Dewar 1991: Appendix 5). Population estimates for Guguletu, as in Langa, are not consistent but the generally accepted figure is around 129 500. There are 8 156 formal houses, 3 700 informal structures, hostels that accommodate 7 290 people, and backyard shacks that accommodate 3 500 people (Dodson & Dewar 1991: Appendix 5).

Both Langa and Guguletu fell within the jurisdiction of the IKAPA Municipality, a traditional Black Local Authority. Although the IKAPA municipality was responsible for service provision in the areas, the CCC remained the official supplier of electricity to Langa and Guguletu. Throughout the 1980s township residents demonstrated their opposition to apartheid structures, including the Black Local Authorities (BLA), by boycotting rent and service charges. The result is that 93% of the residents in Langa and Guguletu are in electricity arrears and an average of R2 200 is owed by each household (*Southern Suburbs Tatler* 2/2/95). It is unlikely that the CCC will cancel the accumulated debt which currently amounts to R22.6 million (Income Branch CCC 1995) an increase of R1.6 million since it was last reported in Phase 3 (Thorne & Qangule 1994: 11). Between February 1994 and May 1995 the CCC disconnected 4 800 households in Langa and Guguletu (Income Branch CCC 1995).

Originally, residents in Langa and Guguletu all had credit meters but, due to the service boycotts and resulting high electricity arrears, coupled with the on-selling of electricity, the CCC began installing pre-payment meters in these areas. In June 1995, approximately 2 500 dispensers were installed to replace credit meters in Langa and Guguletu. It appears that most of these residents have already begun to repay their debts as 70% of houses in Langa and Guguletu have had prepayment meters installed free of charge (*Argus* 11/10/95).

3.2. Khayelitsha[4]

Khayelitsha is a relatively new township in the Cape Flats about 28 kilometers outside Cape Town. It is a rapidly growing urban sprawl that covers an area of approximately 2 085 hectares. As in Guguletu and Langa, population estimates for Khayelitsha vary widely. The Dodson and Dewar study (1993: 150) estimates the population to be 359 600, while the City Engineer puts the population at 443 300 (Ibid Appendix: 7). The study conducted by Harris *et al* estimate the current population to be between 300 000 and 350 000. Khayelitsha is demarcated in the following manner:[5] Town 1, Town 2 Village 1, Town 2 Village 2, Town 2 Village 3, Town 2 Village 4A, Town 2 Village 4 B, Town 2 Village 4C, Jonkersdam, Bongweni, Tembani, Site C, Site B, and Greenpoint. Table 3-1 indicates the breakdown according to the different settlement types:

4 For an overview of Khayelitsha's history, demographics see Harrison et al 'An overview Of Khayelitsha: Implications for Health Policy and Planning' published by the Medical Research Council, November 1992.

5 For more background information on Khayelitsha (Khayelitsha Town 1, Town 2, Jonkersdam, Bongweni and Tembani refer to Thorne & Qangule (1994) Chapter Two pp.15–16.

Serviced	Formal houses	101 506
Serviced	Informal	109 147
Unserviced	Backyard	40 560
Unserviced	Non-residential/Informal unplanned	96 681

TABLE 3-1 A breakdown of the different settlement types in Khayelitsha
SOURCE Harrison et al 1992:7

Site and Service houses in Site B were introduced in 1985 and, after one month, there were 35 000 inhabitants. In 1990, the population for Site B was at estimated 87 260 and there are more women in the 5-35 category in Site B settlement than any other settlement (Harris et al 1991: 7-8).

3.2.1 Natural hazards

Climatic conditions are one of the determinants of fuel use. According to the Urban Problems Research Unit, there are three main natural phenomena that affect residents of Khayelitsha (Harrison et al 1991: 3):

- winter flooding: The average rainfall in Khayelitsha is 562 mm, of which 60% falls between May and August. The flooding is attributed to 'inadequate landscaping and engineering';
- cold winter temperatures: On average the Cape Town Flats experience temperatures of less than 5^0 C for 36 nights of the year; and
- wind erosion and blasting occurs mainly during the summer months. The Flats are exposed to gale force 'south easters' which are not only uncomfortable, but also damage housing structures.

The latter two affect the entire Cape Flats including Langa and Guguletu:

3.2.2 Electricity Provision in Khayelitsha[6]

The Lingeletu West City Council (LWCC) presently provides basic services to all serviced areas in Khayelitsha, but this arrangement is changing with the establishment of local government structures. Khayelitsha was caught in a political wrangle over which metropolitan sub-structure it should fall under. The demarcation board's decision to include Khayelitsha in the Tygerberg metropolitan was resisted by the Nationalist Party (NP) despite the fact that this was based on a fair assessment of the Western Cape's socio-economic needs and resources. In any case it was recently confirmed that Khayelitsha would be part of the Tygerberg sub-metropolitan (*Argus*, 11/10/95).

In the last four years the responsibility to electrify Khayelitsha has shifted three times. Initially, it was the responsibility of LWCC Electricity Department under an agreement with the CPA and the programme to electrify Khayelitsha began in 1989. At the time, the LWCC bought electricity from Eskom then the transfer of the electricity distribution rights passed from LWCC to Eskom (Thorne & Qangule 1994: 10). Eskom electrified four thousand houses and then passed the responsibility onto the 'Joint Operating Company' called Phambili Nombane (meaning Forward with Electricity). Phambili Nombane, a company of three partners, Eskom, Electricite de France (EDF), and East Midlands Electricity (EME) took over the electrification programme in 1994. Their target is to electrify 45 000 houses in Khayelitsha by December 1996. By May 1995 they had already electrified 22 300 houses (*POWER Lifestyle*, May 1995).

The total number of domestic users for Khayelitsha in October 1995 is estimated to be 35 000 and this includes both formal and informal houses. It is reported that 30% of electricity supplied by Eskom to Khayelitsha is used illegally. In other words, approximately R800 000 worth of electricity is stolen every month by residents who manage to bypass prepayment

6 For a detailed history of the provision of electricity to Khayelitsha see Thorne, S and Qangule, V see Chapter Two, pp. 12–14.

meters (*Cape Times*, 20/7/95). Currently there is a move by the provincial government to improve the services to Khayelitsha and Khayelitsha has been identified as one of the recipients of the 149 RDP projects in the Western Cape (*Argus*, 11/10/95).[7]

3.3. Background information of the sample

This section provides some background information on the research sample for both formal and informal houses including:

- the sample size and housing type;
- percentage breakdown of female to male respondents;
- the respondent's relationship to the household;
- respondent's age;
- sources of income;
- length of occupancy;
- type of tenure and ownership of house and plot;
- average number of people living in a house;
- average number of people living on the property; and
- respondent's views on the prioritisation of basic needs.

As noted in Chapter Two, this project has been managed by different researchers with different training and theoretical approaches. Consequently, the use of different terminology has caused some confusion when comparing the data from different phases. For example, while the authors in Phase 3 differentiate between `woman-headed households' and `female-headed households'; Phase 4 makes no such claim (*cf* Thorne & Qangule 1994: 45). In contrast to Phase 3 where it is assumed that women are the 'energy decision makers', this study seeks to unravel in greater detail the decision making process to explore the dynamics of decision making power and gender since, it is argued, this is a complex process and assumptions cannot easily be made. What is required is further research to reveal how men and women decide to use particular combinations of fuel and appliance use.

3.3.1 Sample size and settlement type

The original sample in this longitudinal study consisted of 118 formal houses but, in Phase 4, this had to be reduced. The reasons were that three of the respondents from Khayelitsha had moved residence and one person refused to continue with the study. The fact that people move, or are simply unavailable or refuse to continue participating in the research are unavoidable problems in longitudinal studies of this nature. These houses were dropped from the sample.

The sample for Phase 4 comprised 114 formal electrified houses. Of the total sample for formal houses, 77 houses (the majority) were drawn from Khayelitsha (67%), and the remainder of 37 houses (33%) were drawn from Langa and Guguletu. As noted earlier, however, the sample in Phase 4 was expanded to include – for the first time – informal electrified houses from Khayelitsha's Site B. As Figure 3.2 indicates, of the total sample, 25% of the respondents live in Langa and Guguletu; 53% came from Khayelitsha; and Site B (informal settlements) made up the remaining 22% of the sample. Langa and Gugeletu have been electrified for over twenty years, formal houses in Khayelitsha have had access to electricity since the mid-1980s, and informal houses in Khayelitsha were electrified in November 1994.

7 The Masakhane project in Khayelitsha has been successful in encouraging residents to pay for their services. Since late August, Khayelitsha residents have contributed R199 000 in rates. The bond houses have been paying R50 a month, while R25 is paid by the informal settlements and R10 for those who are only receiving minimal services (*Argus*, 11/10/95).

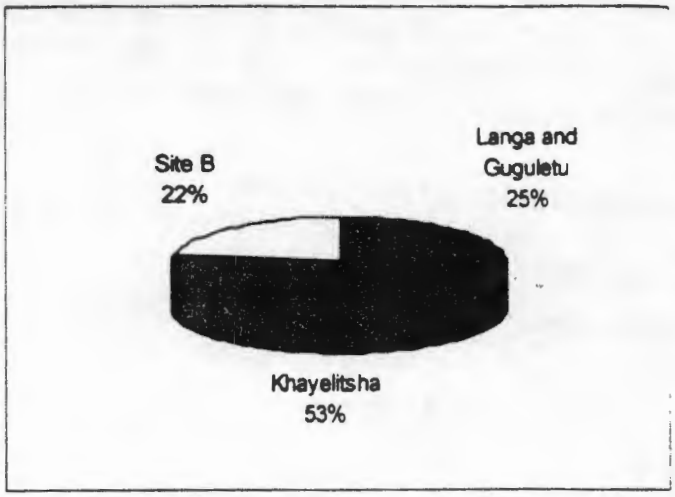

FIGURE 3.2 A breakdown of the sample by area for Phase 4

3.3.2 Percentages of male and female respondents

Of the respondents in Phase 3, 73% were women (Thorne & Qangule 1995: 45). Phase 4 deliberately targeted women as they are the primary users of fuel and would be more likely to provide the reasons for multiple fuel use. In fact, male respondents (12% of the total) were interviewed either because there were no women living in the house or because women were unavailable at the time of the fieldwork. Domestic energy research in the future should seek to examine the views of *both* men and women to uncover the 'gender' dimensions of energy and appliance use. As Figure 3.3 indicates 92% of the respondents in formal houses were women and 8% were men. In the case of informal houses, 76% of the respondents were women and 24% were men.

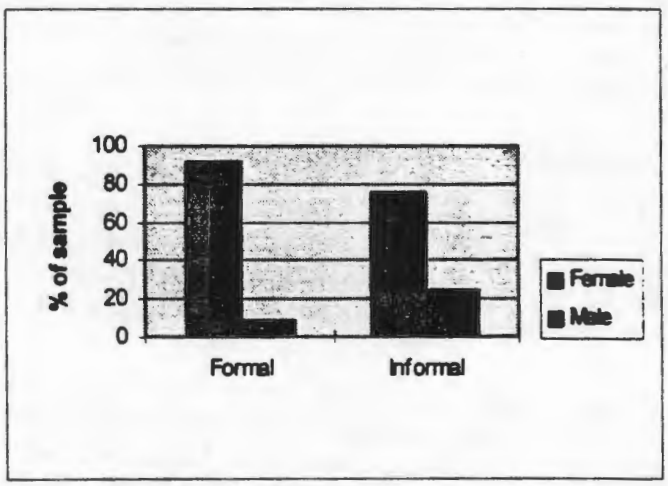

FIGURE 3.3 Percentage of female and male respondents for the formal and informal electrified areas

3.3.3 Relationship to the household

The question 'Who is the head of the household?' was omitted in Phase 4 because 30% of the respondents in Phase 3 were unable or unwilling to answer: 'Some would neither say whether they were the head of the household nor who was the head' (Thorne & Qangule 1994: 45). As it stands, the question tends to overlook subtleties and nuances around decision making in the household and makes no allowance for households where many members of the family contribute to the household budget. Some households are made up of an extended family who contribute to the budget and others might have adult children who do the same. In Phase 4, the aim was to determine the status of the respondents in the household with a focus on

their contribution to the household budget. The unavoidable problem with this approach is that it does not easily allow for comparisons with the data compiled from earlier phases.

As revealed in Figure 3.4, amongst the formal houses in Langa, Guguletu and Khayelitsha, 34% of the respondents were single, 50% were married, 4% were divorced and 11% were widowed. The 'other' category – respondents who are separated from their spouses – constituted 1% of the sample. Among the informal households of Khayelitsha's Site B, 30% were single, 58% were married, 3% were divorced, and 6% were widowed, and 3% were separated.

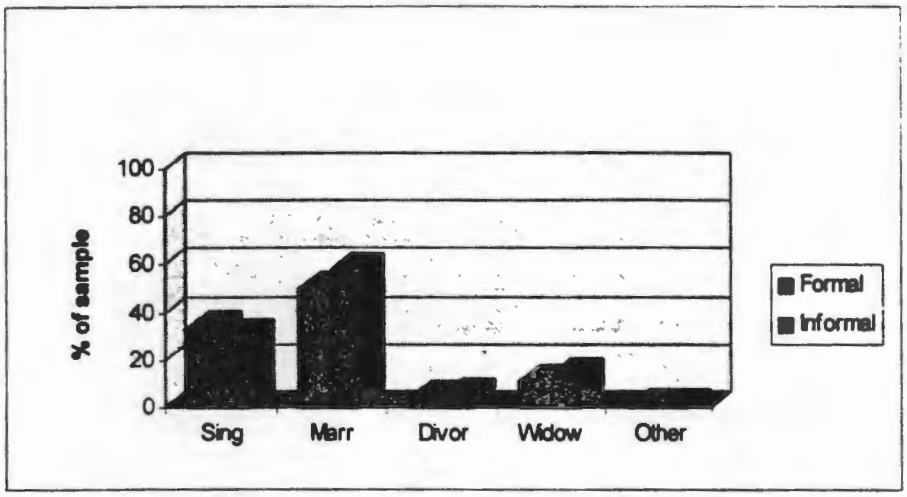

FIGURE 3.4 Status of respondents in informal and formal houses

As indicated in Figure 3.5, of the female respondents, 32% were single, 53% were married, 4% were divorced, 11% were widowed, and 2% were separated. Of the men in the sample, 47% were single, 41% were married, 6% were widowed and 6% separated.

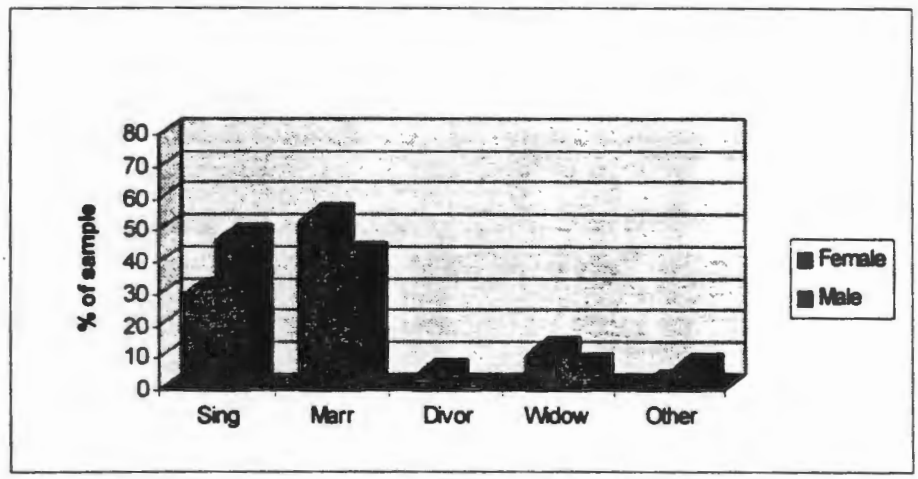

FIGURE 3.5 Status of respondents by gender

3.3.4 Age of respondents

The age of the respondents is an important indicator because it can help uncover generational differences in attitudes and perceptions towards fuel and appliance use. As noted, Langa and Guguletu were chosen as established townships that have been electrified for over 20 years. As demonstrated in Figure 3.6, most of the respondents in Langa and Guguletu were over 35 years old: 49% fell in the age category 35-49 and 41% were in the '50 and above' category. By contrast, most respondents in the formal homes in Khayelitsha were between the ages of 17 and 49: 45% fell in the 35-49 age bracket, 30% in the 25-34 category and 13% in the 17-24 age bracket. Amongst both formal and informal households, most of the respondents (46%) were drawn from the 35-49 age group, followed by the 25-34 age group (22%) sample and 24% of

the informal sample. While 48% of the women interviewed in both formal and informal houses fell into the 35-49 age category, male respondents were concentrated in the 25-34 (29%) and 35-49 (29%) age groups.

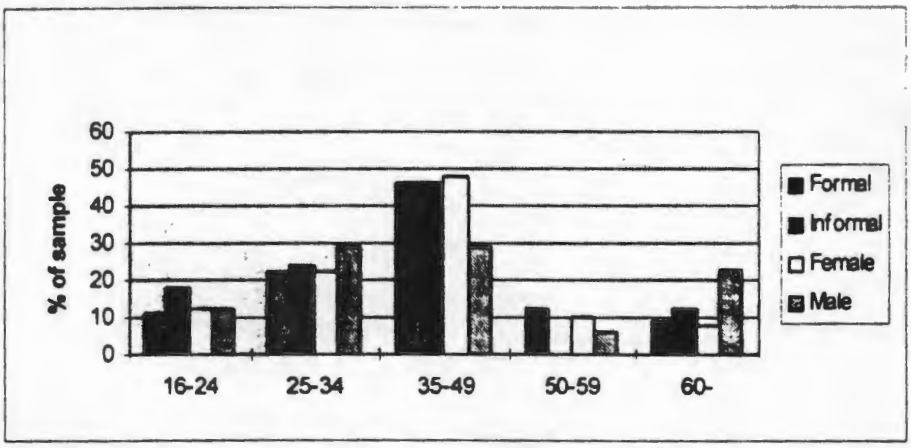

FIGURE 3.6 Age of respondents by settlement type and gender

3.3.5 Household income by settlement type

Amongst the formal households in Khayelitsha, 43% had one income earner, 40% had joint incomes, 6% were entirely self-employed, 7% received pensions and 3% were unemployed. In Langa and Guguletu, 43% reported having one income earner, 13% were self-employed, and 30% households had a joint income and 11% were on pension. In contrast to this, 73% of the respondents in the informal houses reported being dependent on a single income earner, 21% there had two income earners, while one person comprising 3% of the sample was unemployed and fell into the 'other' category (see Figure 3.7).

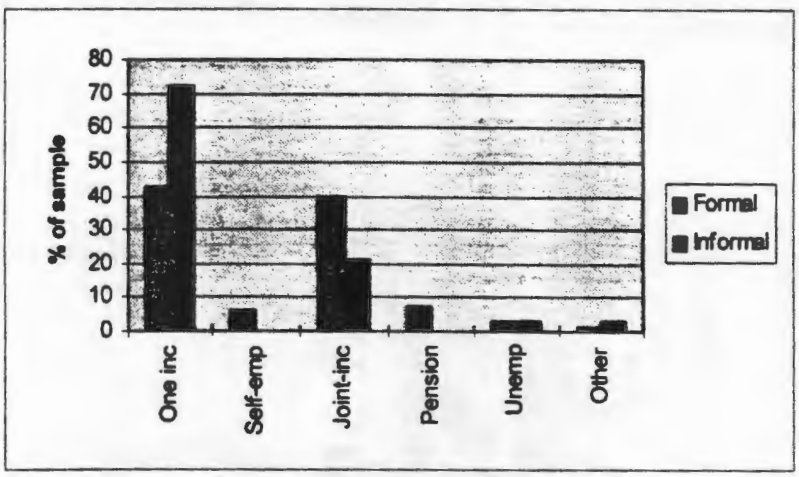

FIGURE 3.7 Source of household income by house type

If the numbers of joint and single income is compared to previous phases, there appears to be a marked improvement in employment levels for Langa and Guguletu (see Table 3-2). However, this may have less to do with improvement in employment opportunities and more to do with the different approaches that have been used to determine what constitutes waged work or changes in the sample under consideration.

Phase 1	42%
Phase 2	46%
Phase 3	35%
Phase 4	73%

TABLE 3-2 Employment levels for Langa and Guguletu

There also appears to be an improvement in employment levels of the sample drawn from Khayelitsha, as shown in Table 3-3. This discrepancy in employment, as in the case of Langa and Guguletu, do not necessarily imply an improvement in employment opportunities and may have more to do with the different approaches that were used to determine waged work or changes in the sample under consideration.

Phase 1	66%
Phase 2	61%
Phase 3	51%
Phase 4	88%

TABLE 3-3 Employment levels in Khayelitsha

3.3.6 Length of occupancy

Amongst the formal households, some of the respondents from Langa had been living there since 1938, while some respondents from Guguletu had taken up residence from 1960 onwards. Of the sample of formal houses in Khayelitsha, 10% had arrived in 1985, 43% arrived in 1989 and 23% arrived in 1990. In the informal settlement in Site B, all respondents from the sample had taken up residence from 1986 onwards.

3.3.7 Type of tenure and ownership of house by gender

Of the residents in Langa and Guguletu, 92% indicated that they owned their houses after having rented for more than 10 years. Of the sample, 10% of the respondents living in the formal houses in Khayelitsha owned their houses outright. Others were paying the house off through loans (30%), bonds (26%), and subsidies (23%), 11% did not respond. The question was not applicable as these respondents continued to rent their accommodation.Of the respondents in informal settlements, 92% owned their houses.

While women remained the majority owners of plots and property in Langa (59%) and Guguletu (55%), 32% of the houses were owned by joint partners and 5% were owned by men. In contrast, the majority of houses in Khayelitsha were jointly owned (61%), followed by houses owned by women (21%), male owned (12%). Of the houses in the Site B sample, 67% are owned jointly, 18% are owned by men, and 15% are owned by women.

3.3.8 Size of Households

In Khayelitsha, the average numbers of people in a formal household over the three phases were reported as 4.3, 3.8 and 4.3 respectively, while in Langa and Guguletu the average number of people per household were reported as 7.7, 5.8 and 6.5 (Thorne & Qangule 1994: 44). The size of the household is reflective of the age of the settlement. For example, Langa and Guguletu are older townships where people tend to be more settled compared to Khayelitsha, a younger and more dynamic settlement. As Figure 3.8 indicates, the distribution of number of people per household for Khayelitsha is skewed left around the median and the median value is 4 people per household. In the case of Langa and Guguletu, the distribution of number of people per household is skewed to the right around the median at 6 to 7 persons per household. The average number in a household in Khayelitsha is likely to increase in the future as the settlement becomes more stable.

The average number of people per household in the informal houses is between 4.5 and 5 (see Figure 3.9) and is indicative of poverty considering that these houses occupy very small spaces. The household size is likely to influence fuel use, including electricity consumption.

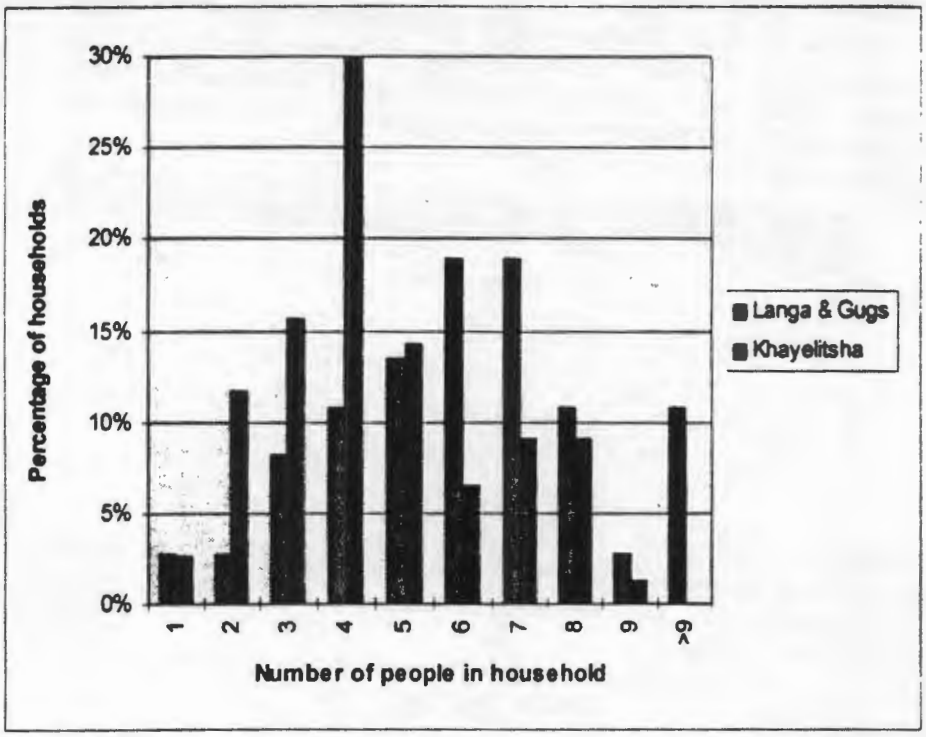

FIGURE 3.8 Average household size in formal settlements

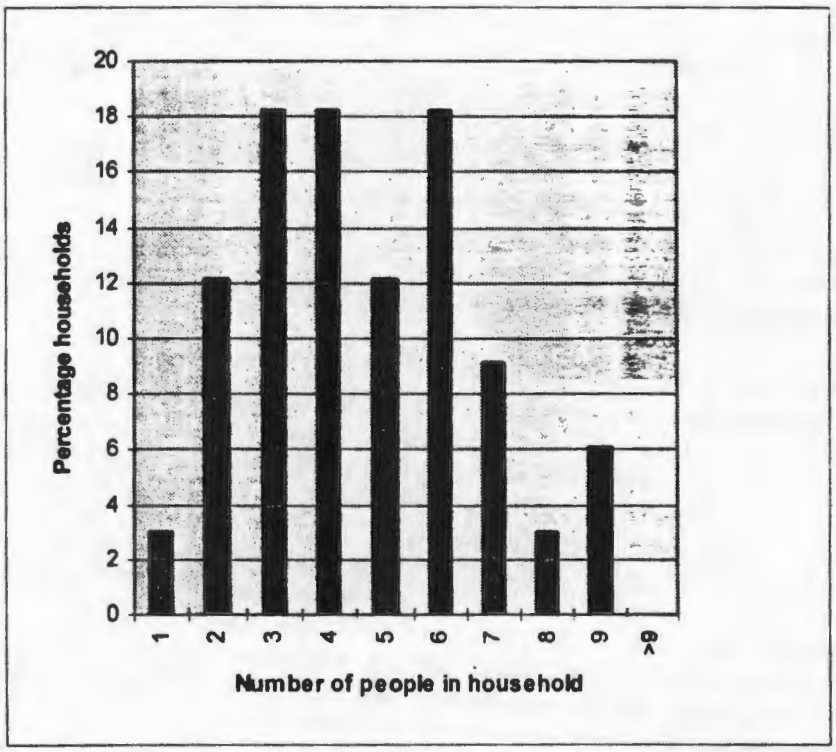

FIGURE 3.9 Average household size in informal houses

3.3.9 Domestic needs and priorities

One of the questions attempted to explore how the respondents rated their immediate needs with regard to education, employment, electricity and other. Respondents had to give at least two answers which were recorded in terms of the priority assigned to them, and these responses were analysed on the basis of settlement type and gender.

As Figure 3.10 indicates, amongst informal households, 46% of the respondents regarded employment as the most important need, while 34% of the respondents from formal houses

saw education to be the top priority. In terms of the 'gendered' responses, 31% of the women regarded education as the priority and another 31% regarded employment as the main priority. Of the men in the sample, 41% regarded employment as important and this was followed by 23% who saw electricity as the most important need to be satisfied. These do not total to 100% as in each case 'other' needs were included. It is interesting to note that electricity rates low in terms of household priorities. This could be explained by the fact that all the respondents in formal households are electrified or that they and are accustomed to engaging in multiple fuel use.

As shown in Figure 3.11, education was regarded as the second most important need by the respondents from informal houses (33%), while formal houses regarded employment as important (30%). Majority of women viewed employment (29%) and education as the most important second need (21%), while the men regarded electricity as important (29%), followed by housing (17%), education (17%) and employment (17%).

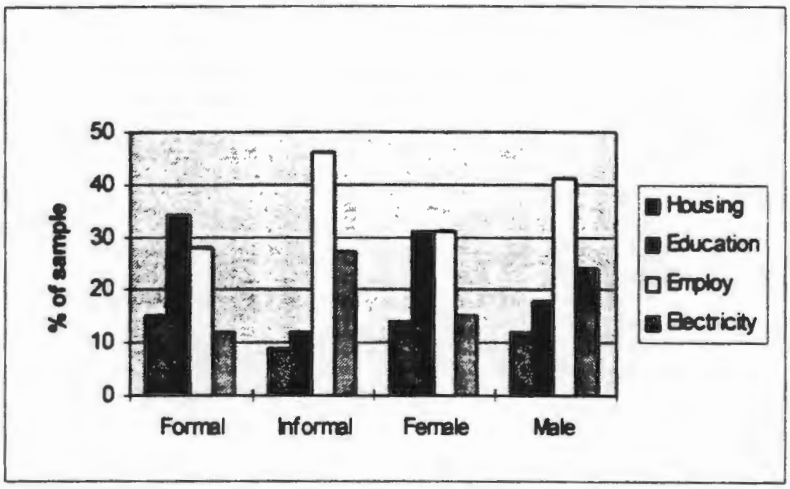

FIGURE 3.10 Identification of first need

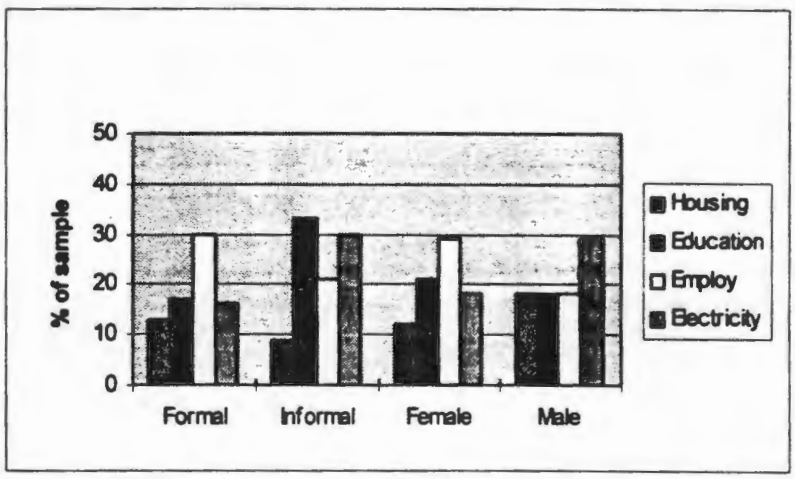

FIGURE 3.11 Identification of second need

Electricity consumption patterns in Langa, Guguletu and Khayelitsha

This chapter forms an important component of the study and examines the following areas:

- the level of electricity payments by domestic users in Langa and Guguletu;
- the overall electricity consumption as well as the seasonal variation in electricity consumption in Langa and Guguletu for Phase 4;
- a comparison of the electricity consumption for Langa and Guguletu from Phase 2 to Phase 4;
- the average household electricity consumption in Khayelitsha from January 1994 to September 1995;
- a comparison with the previous phases of the average monthly electricity consumption in Khayelitsha during Phase 4;
- the extent of electricity provision for households in Khayelitsha from January 1994 to September 1995;
- electricity consumption frequencies for January 1994 to September 1995;
- the average consumption compared to the number of electricity users;[1]

As mentioned in Chapter Two, it was difficult to conduct consistent analysis of the longitudinal data as the information from the previous phases was not stored in a common data base and different computer packages were used to analyse the data. The following information was outstanding at the time of analysis: i) average monthly consumption details for Langa and Guguletu during Phase 1 as only combined data for the two townships were recorded in Phase 1 (Theron 1992: 41); ii) the consumption figures for Khayelitsha for July 1992; and iii) the consumption figures for Langa and Guguletu for December 1992 (Thorne & Qangule 1994: 19) ; iv) and the consumption details of the Khayelitsha sample for Phase 4. It was difficult to secure the relevant consumption data for all areas. Future longitudinal studies should secure the co-operation and support of the relevant electricity supply authorities *before* embarking on such a study.

Langa and Guguletu townships were electrified over twenty years ago. They were therefore chosen as part of the sample in order to compare the energy consumption patterns of such more established settlements with recently electrified, formal houses in Khayelitsha. However, the different metering systems, which might encourage different behaviours in electricity consumption, were overlooked. At the start of this longitudinal study *all* the residents in Langa and Guguletu had credit meters while the houses in Khayelitsha were installed with prepayment meter boxes. As a result of the electricity payment arrears situation in Langa and Guguletu, the CCC began replacing credit meters with prepayment electricity meters. For Langa and Guguletu, Phase 4 analysed the electricity consumption patterns of only residents with credit meters while for Khayelitsha, consumption patterns of residents with only prepayment meters were analysed.

1 I am greatly indebted to Yaw Afrane-Okese who generated all the graphs in this chapter.

4.1. Langa and Guguletu

4.1.1 Method used to analyse the consumption data for Langa and Guguletu

The CCC provided the overall individual electricity consumption data for Langa and Guguletu households as well as the consumption details of the respondents from January 1994 to January 1995. During Phase 1 to Phase 3 all the residents had credit meter systems and data analysis was relatively less complicated. However, Phase 4 coincided with the CCC disconnection programme in Langa and Guguletu which began in February 1994 and by May 1995, 4800 houses were disconnected. As a result, there were many zero consumption figures in the data. The zero consumption meant that electricity supply to residents in arrears was either disconnected and later reconnected or disconnected and then replaced with pre-payment meters.

As a result certain consumption data for Langa and Guguletu was excluded from the analysis. These fell into two categories, namely:

- Households with consumption figures of 2000 kWh/month and more were omitted on the basis that the consumption was too high for domestic use. Inclusion of this data would have distorted the average domestic consumption for these areas. The high domestic consumption in the area could be a result of 'on-selling' of electricity from the main houses to backyard shacks or the consumption records of spaza shops, churches or schools in the area;
- Households which had consumption records for less than 6 months. This could mean one of three things, namely that these households were in arrears and disconnected, or else they were disconnected and then reconnected, or disconnected and installed with a prepayment meter.

In the previous phases consumers for Langa and Guguletu were divided into three categories, namely:

- Category 1: those who are making no payment (arrears still increasing);
- Category 2 : those who have made some payment but their arrears are still increasing;
- Category 3 : those who are making payment which are reducing arrears (Thorne & Qangule 1994: 33).

The information provided by the CCC for Phase 4 appeared in the following categories i) those households who are in arrears (Y); ii) those households whose arrears are increasing (I); iii) those households that are making payments (P). These categories, which are by no means mutually exclusive, will be used in the analysis of Phase 4's data.

4.1.2 The universe and sample in Langa

The first three phases used a baseline of 3500 formal households for Langa. However, according to Dodson and Dewar (1991: Appendix 5), there are 3120 formal houses in Langa and therefore the latter figure will be used. According to the information provided by the CCC, 88.4% of the total number of formal houses have electricity. It is important to note that this record includes houses with consumption over 2000 kWh/month as well as houses with records of less than 6 months of consumption. These records do not include houses with prepayment meter systems.

The sample in Langa consists of 17 houses, one less than the previous phases, as one respondent refused to continue with the study.

4.1.3 The universe and sample in Guguletu

There are approximately 8156 formal houses in Guguletu (Dodson and Dewar 1991: Appendix 5). The sample for Guguletu, as in previous phases, is 20 houses.

4.1.4 The level of electricity payment in Langa and Guguletu during Phase 4

As shown in Figure 4.1, almost all the households in both Langa and Guguletu connected to electricity are in arrears with electricity payments (97% of all customers in Langa and 92% in Guguletu). In fact, residents in Langa and Guguletu owe the CCC R22.6 million for electricity arrears. In terms of paying off electricity arrears, residents in Langa (60%) seem to be making greater efforts than residents in Guguletu (40%). As a result, electricity arrears in Guguletu is increasing at a higher rate (69% of households) than residents in Langa (63% of households). The arrears in electricity bills is likely to impact on consumption and contribute to multiple fuel use.

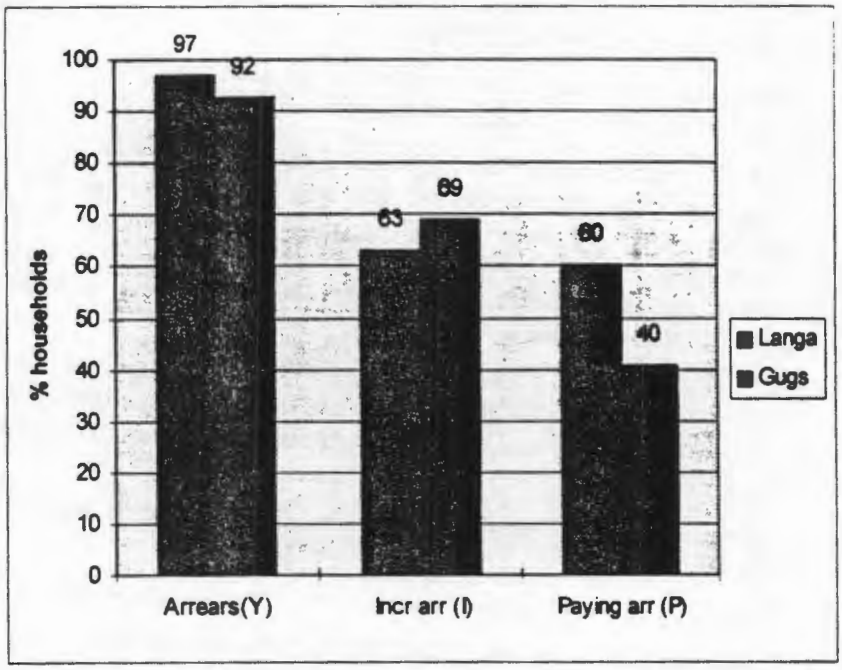

FIGURE 4.1 Level of electricity arrears in Langa and Guguletu during Phase 4

4.2. Electricity consumption in Langa

4.2.1 The overall electricity consumption in Langa during Phase 4

Residents in Langa, whose electricity arrears are increasing even though they are making some payments (I) and those who are paying off their arrears (ie arrears reducing) (P), consumed less electricity than those residents who are generally in arrears (with no payment) (Y) as depicted in Fig 4.2. From this figure, it appears that those residents who are paying are more cautious with their consumption of electricity than those who are generally in arrears with no payment.

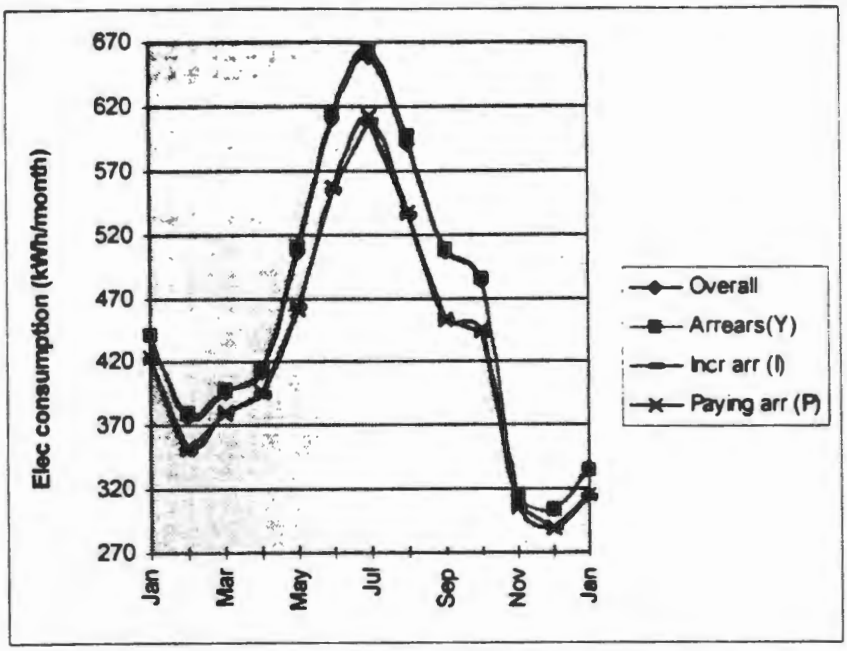

FIGURE 4.2 Electricity consumption in Langa for Phase 4 (Jan 1994 – Jan 1995)

4.2.2 Seasonal variation of the average electricity consumption in Langa during Phase 4

The electricity consumption levels during winter amongst Langa residents are different from those of summer. As observed in the first three phases, in winter, household electricity consumption in Langa is generally higher than in summer and this is mainly due to space heating and an increase in water heating during winter. As Figures 4.3 and 4.4 indicate, while average monthly electricity consumption for households in Langa ranged between 288 and 337 kWh in the summer months (November 1994 to Jannuary 1995), the winter months (May – July) recorded higher average consumption values ranging from 470 to 660 kWh.

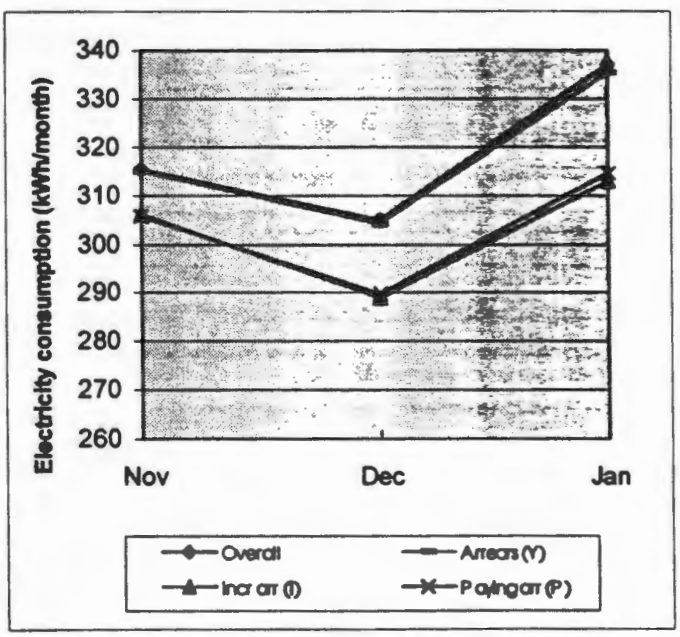

FIGURE 4.3 Average household electricity consumption in Langa during summer (November 1994 – January 1994)

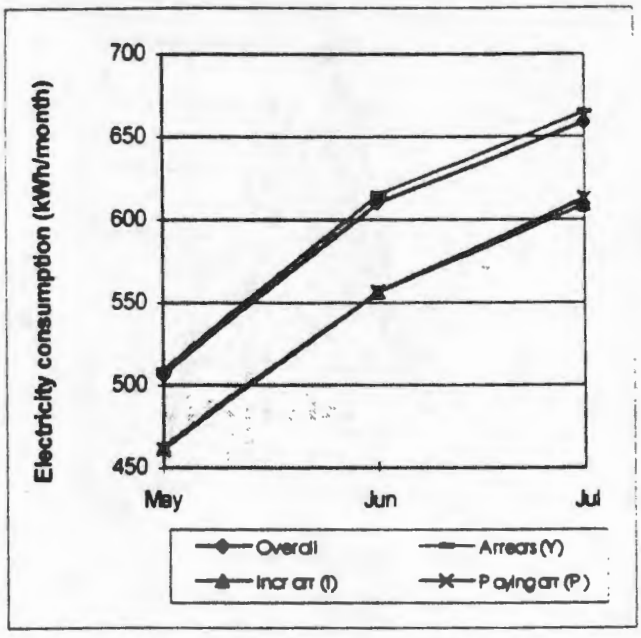

FIGURE 4.4 Average electricity consumption of households in Langa during Winter (May–June 1994)

Amongst Langa residents there seem to be distinct differences in the electricity consumption of the different categories of arrears payment during both summer and winter. In Figures 4.3 and 4.4 various payment categories are shown: those residents who are generally in arrears (Y), those whose arrears payments are not sufficient to effect reduction in accumulating arears (I), and those whose payments are actually reducing their arrears (P). Figure 4.3 illustrates a clear departure of categories P and I from those in general arrears (Y) and the overall trend. This deviation represents a reduction in consumption of about 10 to 25 kWh/month from November to January. Thus in summer, those making some arrears payments (P and I) practised electricity conservation in order to reduce costs while those making no payment did not appear to see any incentive for electricity conservation.

In the winter months Figure 4.4 shows that the deviation of categories P and I from categories Y and the overall trend tend to be wider than during summer. In this case the deveiation represents a reduction in consumption of about 50 kWh/month.

It is also interesting to note that the departure of categories P and I were almost identical. This shows that the extent of payment (either enough to reduce arrears or insufficient to allow increase in arreas) has little effect on the extent of electricity conservation. Rather, it appears that arrears payment was more a function of affordability.

4.2.3 Electricity consumption in Langa from Phase 2 to Phase 4

Figure 4.5 shows the average household electricity consumption in Langa from Phase 2 to Phase 4. Phase 1 did not report on the average electricity consumption for all households in Langa, and the data for the sampled households was also reported as a combination with that of Guguletu (see Theron 1992: 39–41). Thus Phase 1 could not be included in Figure 4.5 for the analysis. It must be noted from Figure 4.5 that the consumption distribution of the sample over the period of Phase 4 seems to be more representative of the universe (and probably more reliable) than in the earlier two phases (Phases 2 and 3).

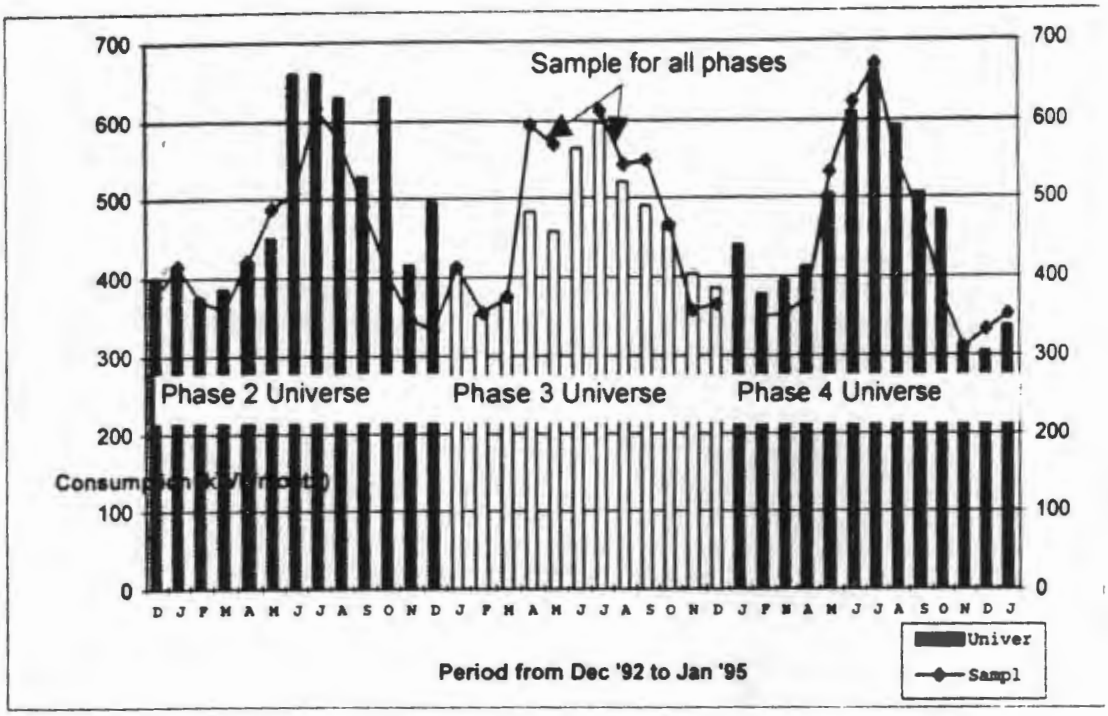

FIGURE 4.5 The average household electricity consumption in Langa for Phase 2-4 (1992,1993, 1994)

While the average electricity consumption seems to have been underestimated from July to December for the households in the sample of Phase 2 compared to the universe, the average consumption seems to have been overestimated for the sampled households for most of the period of Phase 3.

Phase 1 reported that there was no discernible seasonal effect on the electricity consumption amongst the sampled households in Langa and Guguletu (Theron 1992: 39). On the contrary, the most noticeable trend in the following three phases (Phases 2 - 4 in Figure 4.5) is a cyclical rise and fall of both the sample and universe electricity consumption trends depending on the seasons. It can be generally observed that electricity consumption is much lower in the summer months than in winter – which highlights the fact that electricity consumption is influenced by the seasons.

Phase 1 reported a very high summer consumption mean of about 585 kWh/month for the combined sampled households in Langa and Guguletu. On the other hand, the summer average consumption figures observed for all of the following three phases depicted in Figure 4.5 are much lower. In fact, the summer consumption for the three phases ranged mostly between 300 and 400 kWh/month. The average summer household electricity consumption recorded for Phase 4 (particularly between November and January 1994) ranged from 300 and 330 kWh/month and this was the lowest average consumption range recorded in this longitudinal study. This observation in Phase 4 is related to the arrears situation and could be seen as an attempt by residents to save electricity.

Concerning winter electricity consumption, Phase 1 reported a mean of about 644 kWh/month for both Langa and Guguletu, which is consistent with the winter consumption range observed for the subsequent three phases depicted in Figure 4.5. This high monthly consumption range occurred between June and August for all the three phases and it was 630 – 660 kWh for Phase 2, 520 – 600 kWh for Phase 3 and 590 – 660 kWh for Phase 4. It is interesting to note that household electricity consumption peaked in July in all the three phases and the higher peaks (660 kWh/month) in Phases 2 and 4 (compared with that of Phase 3, 600 kWh/month) could be attributed to the extent of severity of the winters for those years.

4.3. Electricity consumption in Guguletu

4.3.1 The overall electricity consumption in Guguletu during Phase 4

The electricity consumption trends for the various categories of arrears payment are completely different from the situation in Langa. As illustrated by Figure 4.6, the electricity consumption paths for the three categories of arrears payment (P, I and Y) followed almost the same path as that of the overall consumption pattern over the whole period of Phase 4. This shows that, in Guguletu, the level of arrears payment did not play any significant role in the behaviours of the people concerning conservation of electricity as was the case in the Langa community. This could be due to the different perceptions or experiences of the two communities.

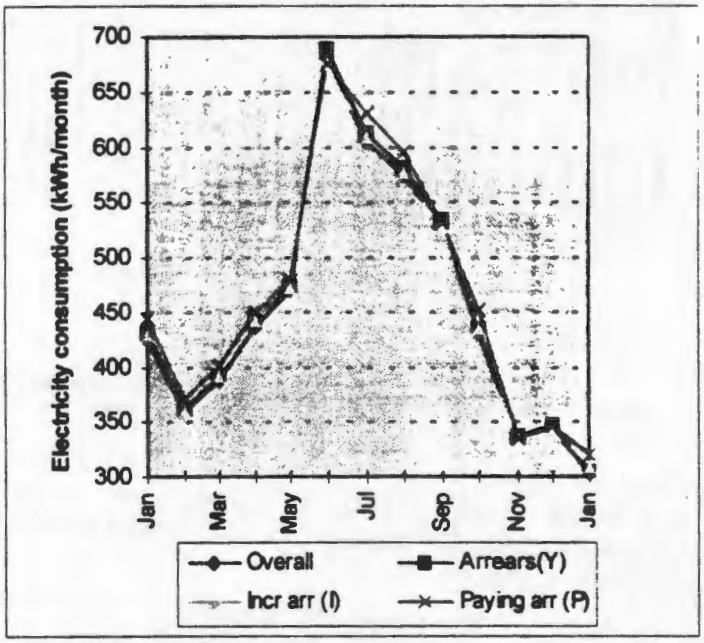

FIGURE 4.6 Overall household electricity consumption in Guguletu for Phase 4

4.3.2 Seasonal variation of the average electricity consumption in Guguletu during Phase 4

Similar to Langa, household electricity consumption in Guguletu is higher in winter than in summer. As Figure 4.7 indicates, the winter consumption between May and July ranged between 470 and 690 kWh/month, a much wider range than in Langa, and the trend over the period was almost the same. However, the summer consumption range (305 – 345 kWh/month) was a little higher than that of Langa. It is worth noting that a smaller fraction of households in Guguletu are paying their arrears than in Langa. Even a detailed illustration of summer and winter consumption trends, shows insignificant separation of the categories.

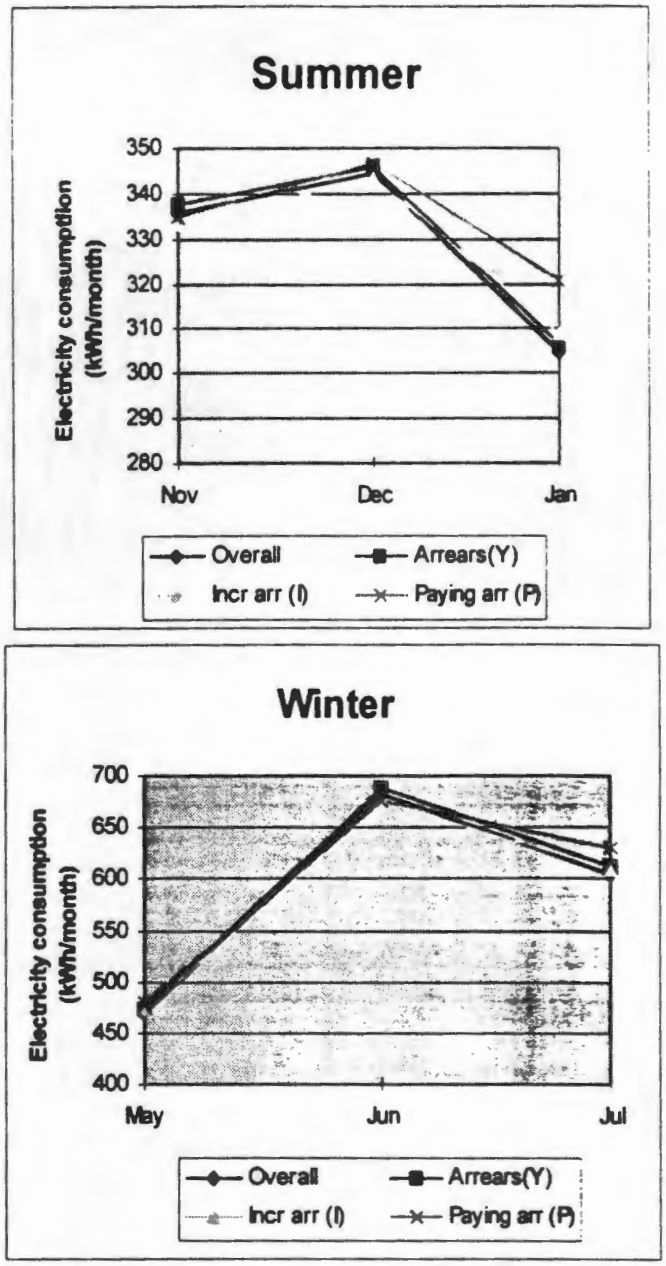

FIGURE 4.7 The average electricity consumption in Guguletu for summer and winter

4.3.3 The average household electricity consumption in Guguletu for Phases 2-4

Figure 4.8 shows the average household electricity consumption in Guguletu for both the sampled households and all the households (the universe) from Phase 2 to Phase 4. For the same reason given in Section 4.2.3 Phase 1 could not be included. It must be noted that, unlike in the case of Langa where electricity consumption for the sampled households was close to the universe consumption for all the phases, the electricity consumption in the sampled households in Guguletu was mostly above that for the universe in all three phases. One must therefore be cautious equating energy consumption patterns of such small samples to the population consumption patterns. Also, if multiple fuel use is common practice among the sampled households which have higher electricity consumption, one could imagine how much more common a phenomenom it would be among the general population which has lower average electricity consumption.

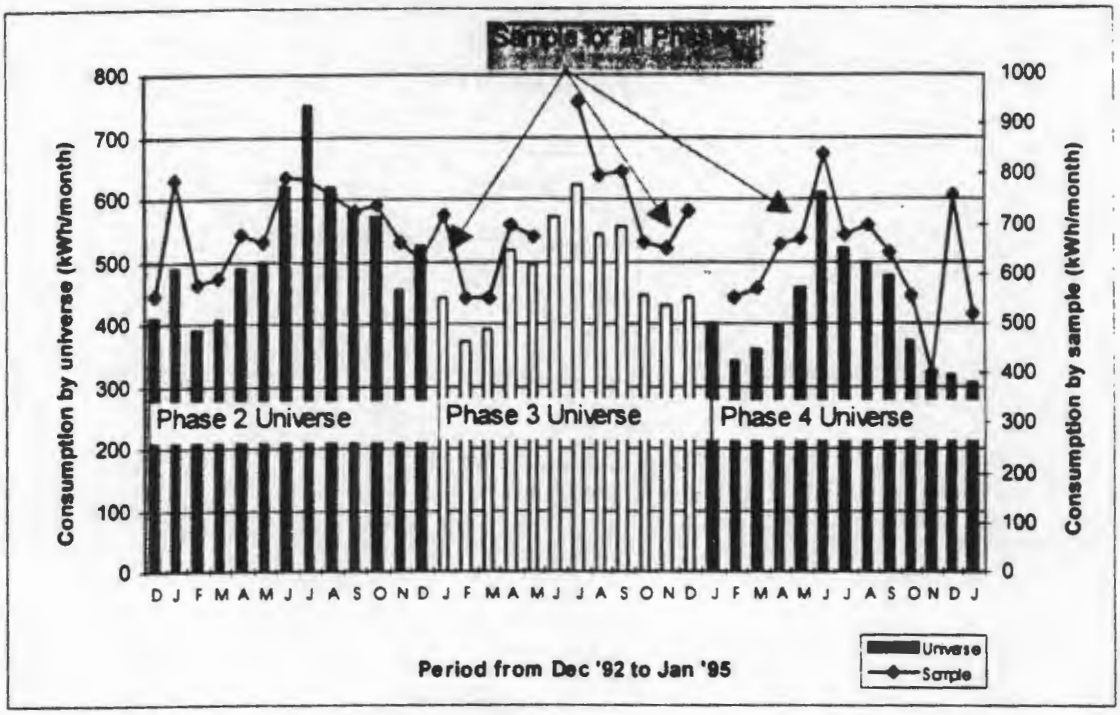

FIGURE 4.8 The average household electricity consumption in Guguletu for Phases 2-4 (1992,1993, 1994)

Seasonal variation in electricity consumption in Guguletu was as clearly marked as in Langa. The trend was the same cyclical rise and fall in consumption. Apart from the winter in Phase 2, where the population consumption shot up as far as 750 kWh/month in July, the electricity consumption by Guguletu residents generally ranged between 300 and 620 kWh/month.

Although levels of arrears payment did not seem to have influenced patterns of electricity consumption in Guguletu, the arrears situation appears to have had an impact on the actual amount of electricity consumed by the general population. It can be seen from Figure 4.8 that there has been a general decline in electricity consumption from Phase 2 to Phase 4. The winter peaks declined from 750 kWh/month in Phase 2 to 630 kWh/month in Phase 3 and 605 kWh/month in Phase 4. Also the summer minima declined from almost 400kWh/month in Phase 2 to almost 300 kWh/month in Phase 4. This is probably due to a general attempt by the residents to save electricity.

4.4. Electricity consumption in the formal houses in Khayelitsha

The electricity consumption details for Khayelitsha was provided by Phambili Nombane. The consumption details were from records kept from prepayment meter sales and are not always reflective of actual use. Eskom loses an average of R800 000 a month from electricity theft in Khayelitsha. According to Phambili Nombane, there is presently no way of pinpointing where the theft is occurring because they do not differentiate between the domestic consumer base and other community facilities such as schools, churches and shops. Neither is electricity use recorded by the area.

Table 4-1 indicates the extent of electricity provision for households in Khayelitsha from March 1994 to September 1995. There was a marked increase in the number of electricity connections since elections in April 1994 particularly in Town 1 and the 'other' area. There were many contradictions in the data, and in many instances, the number of connections reported in March 1994 (Thorne and Qangule, 1994:9) was higher than those reported in September 1995. This discrepancy could be the result of missing electricity records, disconnections or distorted data, for example. Altogether there are 10 647 formal, electrified houses in Khayelitsha.

Town 1	5000	4604	5153
Town 2, Village 1	3477	1026	723
Town 2, Village 3	4465	2340	2541
Town 2, Village 4a	264	264	217
Bongweni	300	300	171
Other			1290

TABLE 4.1 Extent of electricity provision for households in Khayelitsha (March 1994–September 1995)

4.4.1 Electricity consumption frequencies in Khayelitsha households

Electricity consumption in formal electrified homes in Khayelitsha is generally very low. In fact, almost half of the formal electrified homes (47%) consume not more than 140 kWh/month, as depicted in Figure 4.9. Almost three quarters (73%) of households consume 250 kWh/month or less. A mere 8% of the residents consume 400 kWh/month or more, the equivalent of domestic consumption in white suburbs in central Cape Town. Therefore it can be concluded that, although residents in Khayelitsha have access to electricity they cannot afford to use it fully.

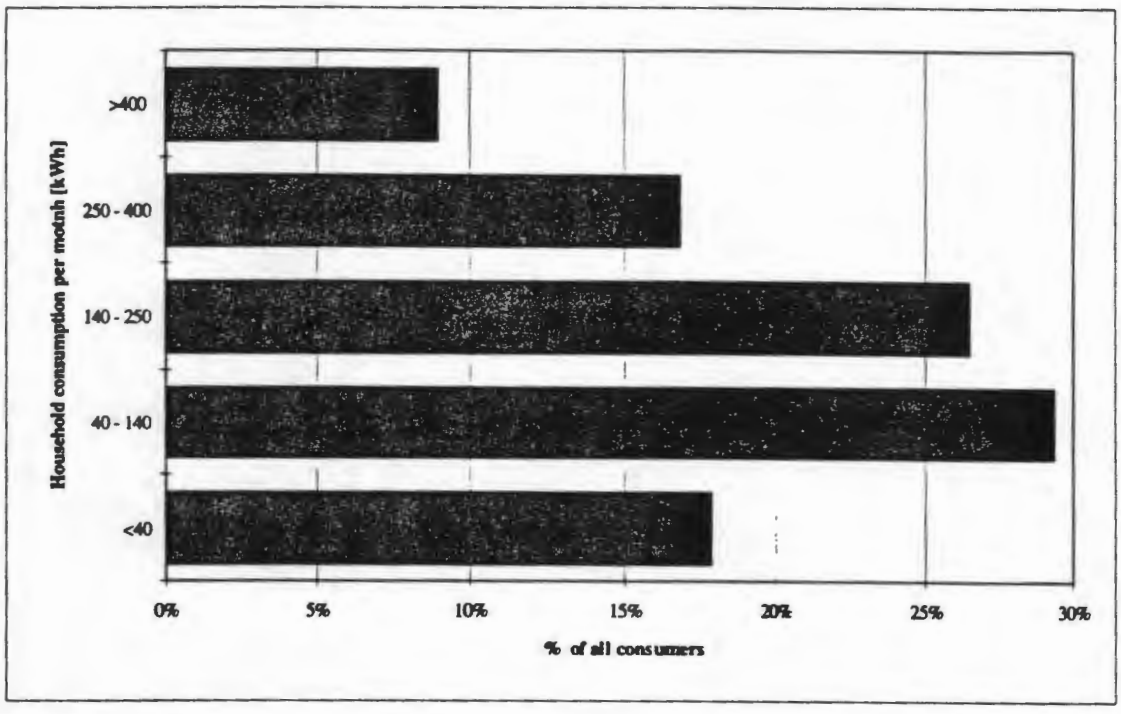

FIGURE 4.9 Electricity consumption frequencies in Khayelitsha during Phase 4

4.4.2 Electricity consumption patterns for the various areas in Khayelitsha

The previous phases examined the electricity consumption of the various areas in Khayelitsha separately. Phase 4 combines the average electricity consumption in Khayelitsha and compares it with the consumption of the various areas in Khayelitsha. The consumption data for Jonkersdam was not provided by Phambili Nombane.

A close look at Figure 4.10 indicates that there was very little variation in the average electricity consumption for all consumers in all areas over the seasons of Phase 4 (All). However, for each of the various areas the seasonal variation wasgreater. Households in T1, T2V3 and T2V1 had consumption trends very close to the average consumption for all consumers throughout Phase 4 whilst households in Bongweni, T2V4a, and the "other"

areas generally consumed more electricity than the overall average (All). In all, Bongweni residents consumed more electricity than all the areas for the whole of Phase 4. On the other hand, residents in T1 consumed the least electricity during Phase 4 except from January 1995 to June 1995 when residents of T2V3 recorded the least consumption figures. Electricity consumption in Bongweni in Phase 4, as in the previous phases, continues to be affected by the seasons. At the beginning of Phase 4 (January – April 1994), electricity consumption was between 150 and 340 kWh/month while the consumption for October 1994 was unusually high.

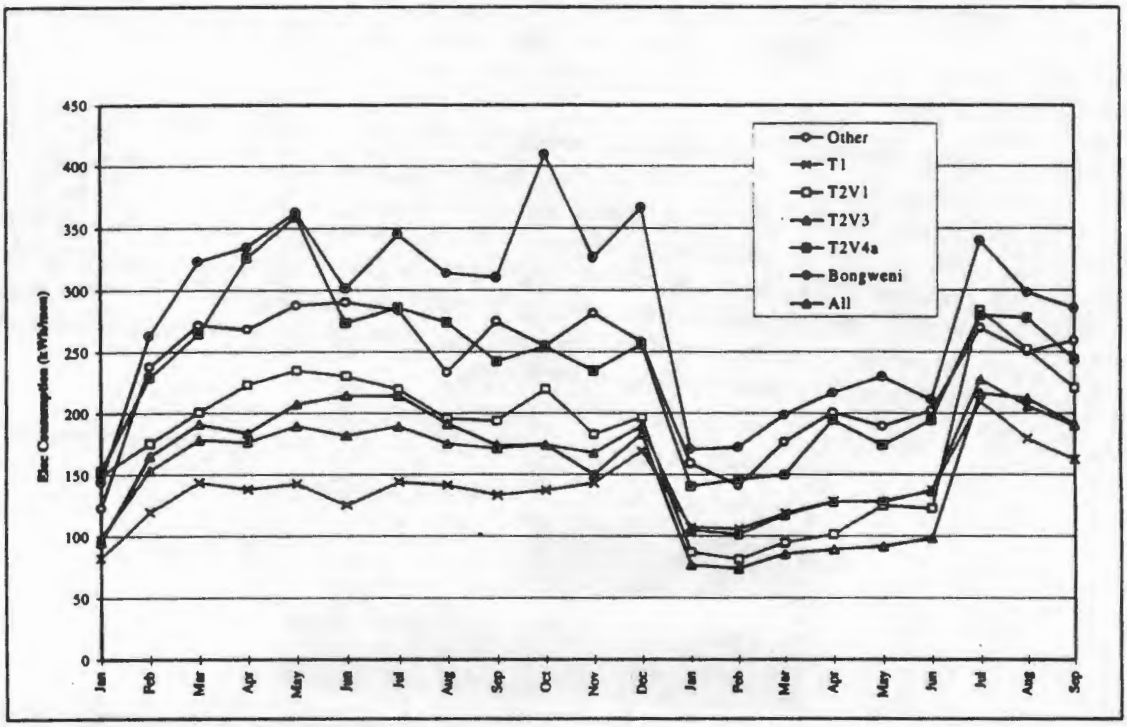

FIGURE 4.10 Electricity consumption patterns in various areas in Khayelitsha (Phase 4: Jan 1994 – Sep 1995)

As Figure 4.10 indicates, the seasonal impact on electricity consumption in Khayelitsha for all consumers from January 1994 to December 1994 is low compared with the situations in Langa and Guguletu where seasonal variations were more distinct. A comparison of consumption between 1994 and 1995 over the period January to June shows that there has been a decline in 1995. This decline in electricity use could be an indication of greater multiple fuel use by low-income households. Alternatively, these lower levels of consumption could be associated with electricity theft.

4.4.3 The average household consumption in Khayelitsha for Phase 1 - 4

As Figure 4.11 indicates the overall electricity consumption in Khayelitsha throughout the 4 phases of this study was below 300kWh/month. Thus electricity consumption amongst residents of Khayelitsha is far below that of Langa and Guguletu. The reason for this could be that communities in Langa and Guguletu are more established with bigger household sizes whilst communities in Khayelitsha are much younger and still unstable with smaller family sizes. Another reason could be that the prepayment system prevailing in Khayelitsha could be scaring residents from using electricity fully and this could lead to greater multiple fuel use.

Figure 4.11 depicts electricity consumption trends for both the total population (the universe) at Khayelitsha and the sampled households. The City Council could not provide the consumption data for the sample for Phase 4 and thus it is missing in the plot of Figure 4.11. It is interesting to note that the electricity consumption of the sample for the first three phases was not reflective of the consumption universe.

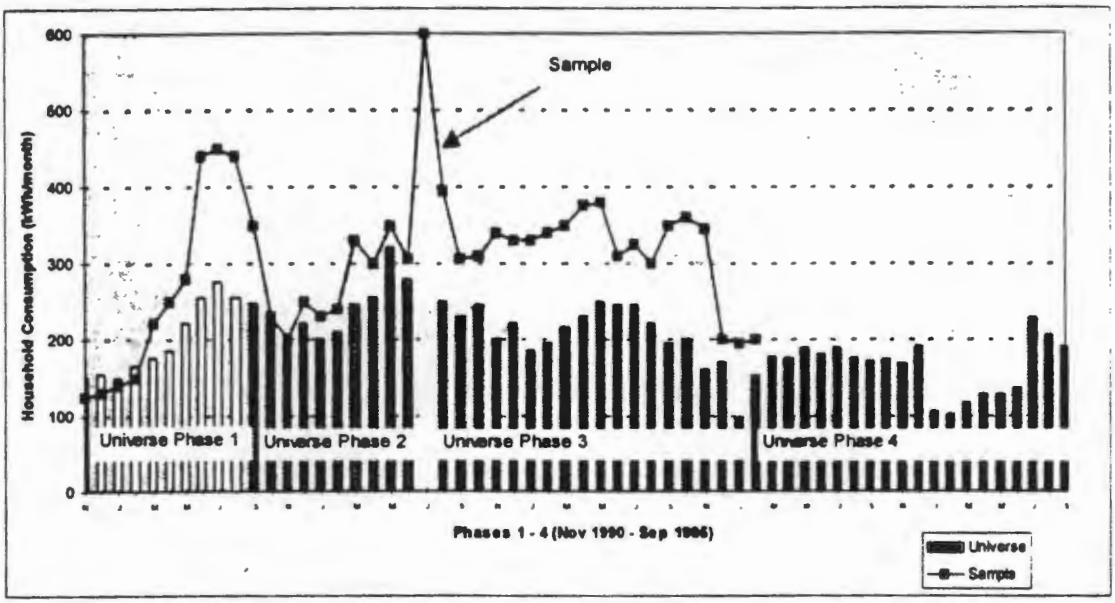

FIGURE 4.11 Average electricity consumption in Khayelitsha from Phase 1 to Phase 4

Figure 4.11 shows that seasonal variation over the 4 phases of the study was not as pronounced as in the cases of Langa and Guguletu. There appears to have been a gradual increase in electricity consumption from Phase 1 to Phase 2, which peaked during May and June. The consumption for Phase 3 remained fairly consistent with the previous phase but there was a sudden decline in consumption during phase 4 when consumption generally dropped below 200 kWh/month, the lowest recorded since the start of this project. The consumption trend over the 4 phases indicates an initial rise in electricity consumption immediately after electricity connection, followed by a gradual decrease in consumption to a more stable level determined mainly by affordability.

4.5. Summary

Several issues have emerged from the analysis of the electricity consumption data over the four phases. There seems to be an overall decline in electricity consumption in formal electrified houses since Phase 1 in Langa, Guguletu and Khayelitsha. This can be attributed in part, to the electricity arrears in Langa and Guguletu, the irregular electricity supply in all three areas and the lack of affordable electrical appliances. It also raises questions about the affordability of electricity. The decline in electricity consumption in formal electrified houses implies that there is a greater use of gas and paraffin. However, domestic electricity consumption in Khayelitsha (especially in Phase 4) is not necessarily reflective of actual use as there is a high degree of electricity theft occuring in the area.

The electricity consumption of the sample is higher than the universe in most cases in all three areas studied. As previous phases indicated, multiple fuel use was practised by the respondents. Households in the universe are consuming less electricity which implies greater dependency on other fuels.

Electricity arrears in Langa and Guguletu has affected domestic electricity consumption in Langa and Guguletu, particularly in the last two phases. In addition, the *type* of electricity metering system seems to have influenced the way in which electricity is consumed. Households with prepayment meters tend to use less electricity than those with credit meters. For example, the average electricity consumption for Khayelitsha throughout the different phases was below 300kWh/month. In contrast to this, the average consumption in Langa and Guguletu ranged between 300 and 660 kWh/month.

The new urban electrification schemes in the Western Cape (directed at formal houses) seems to have been modelled on the consumption trends of white suburbs where the average monthly consumption is 400kWh/month or more. Approximately three-quarters

of the formal electrified houses in Khayelitsha use less than 400kWh/month which is far below Eskom's expectations.

Energy services in low-income formal houses

> Electricity is not cheap, especially for people who do not work like us. – *Formal household in Khayelitsha*
>
> My employers pay R100 for electricity but they have all the appliances: washing machines, geysers, vacuum – but I pay R150 with a very few appliances.

Although electricity is the most convenient form of energy for domestic use, its comforts are not readily available to or affordable by low-income households. There are many barriers preventing low-income from enjoying the conveniences of electricity and, in fact, few households use electricity to fulfill *all* their energy needs. This chapter explores: i) the energy end use services that are fulfilled by electricity in these low-income households; ii) the appliance and fuel combination used by formal electrified homes in Phase 4 to fulfill the different energy needs and services including cooking, refrigeration, ironing, space heating, water heating, laundry, entertainment and lighting; and iii) the determinants (that is cleanliness, reliability and convenience, affordable appliances, affordable fuels, safety, multiple use for example) that shape households fuel and appliance combination.

To ensure a degree of continuity, patterns of appliance ownership in Phase 4 were compared to previous phases. In many instances, particularly Phase 2, findings were inconsistent. This could be attributed to, amongst other things:

- methodological problems in the way the questionnaire was designed and recorded with regard to appliance ownership;
- changes in the sample over four years;
- lack of accuracy in fieldwork;
- respondent's oversights so that 'declines' in appliance ownership may be attributed to omission; and
- the omission of appliances that were broken at the time or were not being utilised.

5.1. Electricity end uses in formal electrified houses

The majority of urban households depend on electricity for cooking, reheating food, refrigeration, media, lighting, space heating and heating water for bathing. However, although low-income households in Langa, Guguletu and Khayelitsha have access to electricity they continue to use other fuels including, for example, paraffin and gas to fulfil certain tasks. As seen in Figure 5.1 electricity is used mostly for media (97%), lighting (96%), refrigeration (90%) and ironing (93%). It is also used by 65% of the respondents for cooking; 43% for heating water (electric geysers); 43% use it for space heating, while the 22% who own washing machines use it for laundry.

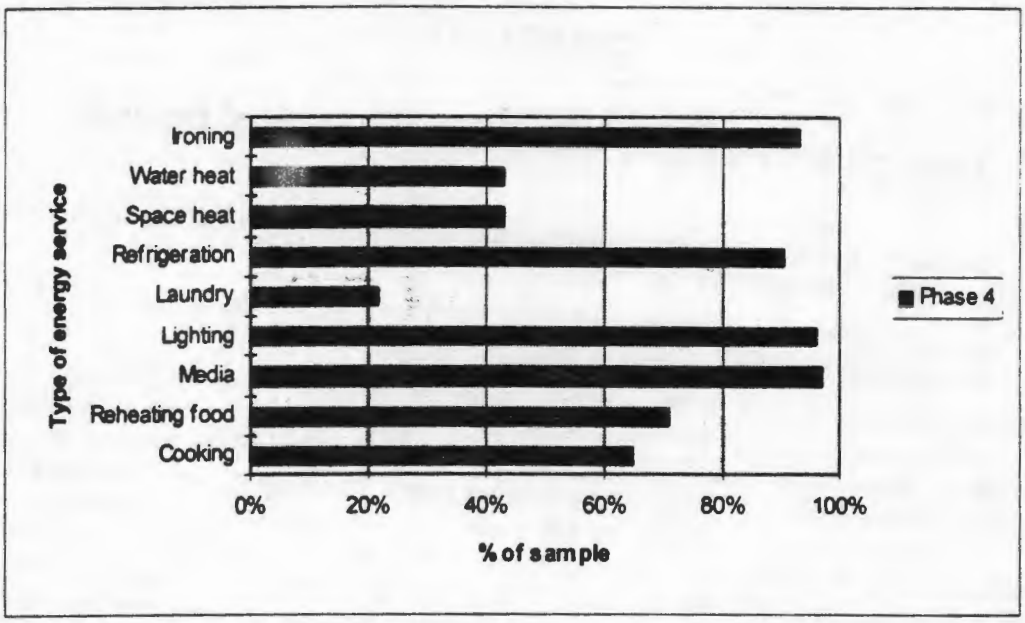

FIGURE 5.1 Domestic energy services for which electricity is used

5.1.1 Monthly fuel expenditure

Figure 5.2 indicates the average monthly expenditure of fuels in low-income households. Wood, car batteries and candles were only used by a few respondents and therefore excluded from the analysis. The fact that these electrified households continue to use other fuels is largely indicative of their socio-economic position. Electricity is seldom used to fulfil *all* end-uses and multiple fuel use has become a common practice. Most households buy fuels on a monthly basis. The expenditure categories for the different fuels are quite distinct. Low-income households seem to spend the most on prepayment electricity, followed by credit meters, gas and paraffin. In fact, almost 44% of the respondents spend between R45 and R100 per month on electricity prepayment meter cards. Of the respondents who have prepayment meters, only 43% use electricity to fulfil all their energy end-uses. Paraffin and gas purchases are bought in smaller amounts. Almost 23% of the formal electrified houses purchase paraffin on a monthly basis – the R15–R25 price range is the most common. Gas (26%) is more popular than paraffin in low-income households. The monthly expenditure on gas ranges between R55–65 and R5–15, however majority of the households seem to spend between R5–R15. Only 12% of the respondents (in Langa and Guguletu) use credit meters and their monthly expenditure ranges from R5–15 to R95 and R100.

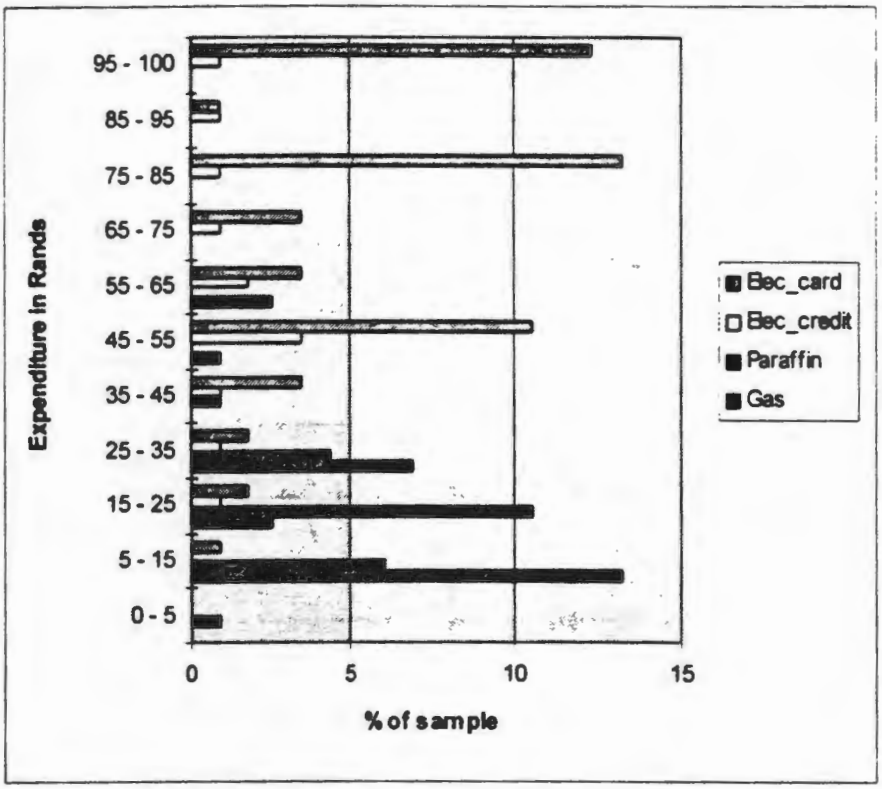

FIGURE 5.2 Monthly expenditure on fuels in Low-income formal electrified houses

5.1.2 Prepayment meter systems

Electricity is used mostly for lighting, entertainment/media and refrigeration by low-income households. Electricity is considered expensive by low-income households and its use must be understood in the context of arrears (in Langa and Guguletu) and the introduction of the prepayment meter boxes. Both Eskom and the Cape Town City Council (CCC) have adopted a policy whereby all newly electrified homes (low-income) will use a prepayment meter card system. The reason for introducing this system is first, to ensure that people pay up front for the electricity they consume and thereby prevent arrears build-up, and second, it aims to make people aware of the cost of electricity and enable them to budget for the electricity they use. The majority of the respondents in the sample for Phase 4 have prepayment meters. This is advantageous so far as the consumer is in control of the amount of electricity used especially amongst those who have been plagued by high bills that could not be accounted for. For example, a respondent in Langa who recently had her credit meter replaced with a prepayment meter saw a reduction in the electricity account from R350 to R80 a month. She is satisfied with this system as she `pays for what she uses' and is able to monitor her electricity consumption. Furthermore, she argues that `it teaches us to economise ... a person knows that for each appliance one adds in the house – means R5 or R10 electricity per month. So it is easy to budget'.

The card system is educational as it teaches people to be energy efficient. One respondent remarked:

> With the card system you know that you use electricity when it is necessary... it is not necessary to switch on all the lights in the house. It is not necessary to fill up the kettle with water when you know that only need a few cups of coffee or tea.

Another advantage of the prepayment meter system is that electricity is made available in small amounts to people whose jobs are insecure or who are poorly paid. Another respondent claimed `electricity is not affordable, the card system is. You can buy electricity with whatever money you have in your pocket'. Women are sometimes willing to pay extra for the comfort and convenience that electricity has to offer: `Rather I pay more for electricity than having to clean walls and suffer coughs with paraffin', nevertheless the high costs of electrical appliances act as a barrier to electricity consumption.

The prepayment meter system may inadvertently discourage people from using electricity for all their end uses. In this manner the prepayment systems can have 'gendered' impacts on its users, as it is cheaper, for example, to use electricity for lighting and media than it is for cooking or ironing. Women, who are generally responsible for household resource management, must be cautious about energy consumption and must find cheaper and sometimes less efficient ways of completing their tasks. A female respondent likened the prepayment meter to sugar `it is like sugar in the house – it's easy to see that you are running out of sugar in your house. Most importantly, you know why a packet of sugar stays longer or shorter – you know that it is the number of family members or visitors at a certain point in time'.

Another respondent observed that people who have prepayment meters seek alternative ways of meeting their domestic energy needs: `what about people who have changed over to the card electricity? – I am told that they start using other fuels especially gas stoves'. According to Debbie Hene, respondents said some users panic when they see the units running. So, while the system makes users aware of the costs attached to particular energy uses, it also has the potential to create conflict in households and discourage people from using electricity. Alternatively, users often find ways to 'extend' their existing supply by tampering with meters and stealing electricity.

Whether or not the prepayment system makes electricity more accessible to low-income households is debatable. People must have cash on hand to enjoy the benefits of electricity: `Because I am a pensioner so I haven't got money to buy a card all the time'. Another respondent remarked `I don't like the card system ... it doesn't appeal to me ... it is good for people who always have money'. For many with the prepayment meter system, `when there is no money, there is no electricity'.

The prepayment card system is likely to impact on households who share energy and/ appliances. `It [the prepayment meter] prevents people from coming to your house and asking to bake, iron and shower. If such people come you can ask them to go and buy their own electricity to use – it is not an issue to use another person's appliances and house – the issue and immediate expense is electricity/fuel'. Another respondent indicated that she bakes at her mother-in-law's place `but I must buy electricity for at least five rand'.

5.2. Cooking

In terms of fuel and human labour, cooking is one of the most energy intensive activities. Due to the gender division of labour, women are primarily responsible for cooking. As indicated in Figure 5.3, 94% of the women were responsible for most of the cooking. Only 1% of the men cooked, while 2% shared the cooking.

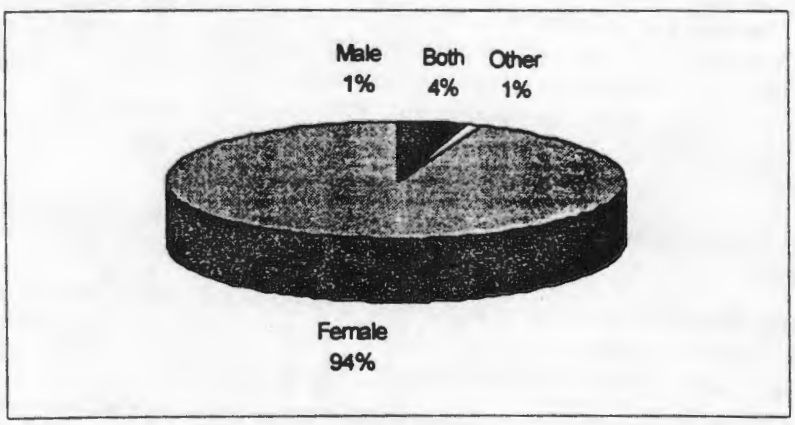

FIGURE 5.3 Person responsible for cooking in formal housing

The women in the sample were generally aware that it was expensive to cook with electricity. In fact, only 65% of the respondents in formal electrified houses used electricity for cooking, while 25% used gas and 10% used paraffin. Although this indicates overall trends in fuel use for cooking, it does not capture multiple fuel use. For example, it does not explain why different fuel and appliance combinations are used for cooking different types of food.

In order to understand the dynamics of multiple fuel and appliance use, two questions were posed: `What fuels do you use for daily cooking?' and `What appliances do you use for daily cooking?'. These questions allowed for more than one answer. The results were often confusing and contradictory and reflected the limitations of quantitative research approaches.

Table 5.1 indicates the different types of fuels used on a daily basis by respondents in Langa, Guguletu and Khayelitsha. In the context of multiple fuel use, electricity is used by 97% of respondents in formal electrified houses for cooking, followed by paraffin (30%) and gas (11%). At face value, it seems the arrears situation in Langa and Guguletu has not affected the electricity consumption of the respondents as it is the most frequently used fuel. However, the simultaneous use of gas and paraffin might demonstrate either an attempt to save electricity (and money), or strategies to overcome unreliable electricity supplies and frequent power cuts. Women also engage in multiple fuel use and appliance use when they cook different dishes but have limited cooking plates. In formal houses in Khayelitsha, electricity seems to be the most popular fuel for cooking (78%), followed by gas (34%) and paraffin (6%) (see Table 5.1). This phase indicates a 14% increase of gas consumption in Khayelitsha over Phase 3 (Thorne & Qangule 1994: 50). This increase could, in part, be attributed to the fact that the original sample changed since Phase 3, attempts to save electricity (and money) or response to unreliable electricity supplies. While these findings shed some light on multiple fuel and appliance use, there is a need for more qualitative research methods to help understand this practice.

Fuels used Daily – Phase 4	% in Langa and Guguletu	% in Khayelitsha
Gas	11	34
Paraffin	30	6
Electricity	97	78

TABLE 5.1 Fuels used daily in Langa, Guguletu and Khayelitsha

As Table 5.2 indicates, electric appliances are the most popular for cooking. Gas appliances are used by over a third of respondents in Langa and Guguletu for daily cooking, while paraffin appliances are used by almost a third. The range of appliances and fuels used in Langa and Guguletu could be explained as an attempt to save electricity in the context of arrears, or impending power cuts. It is also possible that some users have had prepayment meters installed and are becoming aware of the costs attached to each energy service.

The use of hot-plates for daily cooking in Khayelitsha has decreased since the beginning of the study. In Phase 1, 40% of the sample owned hot plates, but by Phase 3, it had dropped to 22%. In Phase 4, this figure had increased by 1% to 23%. There was an increase in the use of 4-plate stoves in Khayelitsha: from 46% in Phase 1 to 68% in Phase 3. In Phase 4, there was a 12% decline in the use of 4-plate stoves and only 53% of the respondents reported using their stoves on a daily basis. This might be explained by appliances being out of order or by the perception that it is more expensive to cook with electricity than with other fuels. Gas stoves are increasingly popular: the use of gas for cooking increased from 20% in Phase 3 to 31% in Phase 4 (Thorne & Qangule 1993: 52).

Comparing appliance use for Langa and Guguletu in Phase 4 with the previous phases was extremely difficult due to insufficient information. However, the use of 2-plate electric stoves appears to have remained constant but there has been a decline in the use of 4-plate electric stoves (from 79% in Phase 3 to 68% in Phase 4) (see Thorne & Qangule 1993: 52). There has been an increase in the use of electric-frying pans from 10% in Phase 3 to 27% in Phase 4. A possible explanation for the decline in the use of electric stoves is the arrears situation and to save electricity. Frying pans are replacing electric stoves mainly because they are multi-purposeful, convenient and seen as consuming less electricity. In Phase 1 none of the respondents were using gas stoves while in Phases 2 and 3 approximately 5% usage was recorded (Thorne & Qangule 1993: 52). There has been a dramatic increase in the use of gas stoves in Phase 4 (38%).

Two-plate electric stove	16	23
Gas stove	38	31
Primus stove	30	4
Electric stove (4-plate)	68	53
Electric-pan	27	3

TABLE 5.2

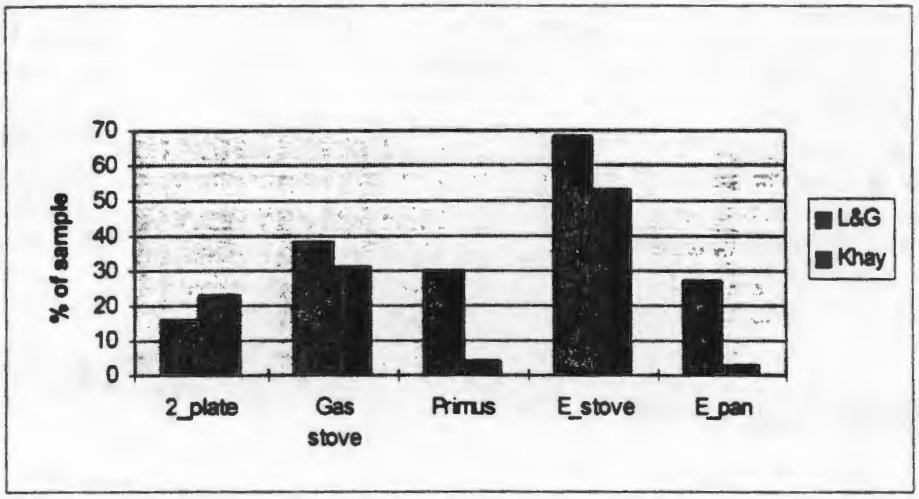

FIGURE 5.4 Cooking appliances used on a daily basis in formal electrified homes

Formal households use fuels interchangeably particularly in times of financial crisis. The question `Do you use different fuels and appliance combinations to cook different dishes?' was asked to determine whether the main cook was in fact using different fuels for different types of meals. Of the respondents in the formal houses, 77% responded negatively, 4% of the respondents claimed to use gas and 7% used paraffin to cook meals that take long to prepare. Of the formal sample, 8% said they used different fuels and appliances simultaneously because they did not have enough plates to cook on. The 'other' category included cooking quick meals and using other fuels to save electricity. A respondent in Khayelitsha uses paraffin to cook samp `because it takes almost 4 hours to be cooked'. Other respondents reported employing fuel and time efficient strategies when cooking foods that take long to prepare. For example, `When we cook the samp mielies we are using electric[ity], we soak the samp first so that it becomes soft. But when we use paraffin or gas we do not mind because it is affordable'.

5.2.1 Different methods used for cooking in formal houses

Phase 3 included a table which explored the different reasons for using a fuel and appliance combination. The reasons given included cleanliness, convenience, reliability, safety, quick, cheap fuel, cheap appliance and multi-purpose. This section only made allowance for one fuel and appliance type. As shown in Figure 5.5, among the 65% electricity users, the main reasons given for using electricity for cooking were because it is clean (88%), quick (85%) and safe (80%). It seems as if electricity was used more because of convenience rather than affordability. Only 15% of the respondents used electricity because it was cheap and 11% found electrical appliances to be inexpensive. Only 66% of the respondents said that they used electricity because it was reliable. This means that the reliability of electricity is not an issue or that the electricity supply is unreliable. This raises the concern that although people have electricity, supply is unreliable. In short, the unreliability of electricity supply, lack of affordable appliances coupled with the perception that electricity is expensive contributes to multiple fuel use.

Gas is widely used amongst the Phase 4 sample. The reasons given for using gas were that it was cheap (82%), clean (71%), and quick (79%). It is interesting to note that 71% of the

respondents stated that they used gas because it was reliable. However, gas is seen to be dangerous: only 43% of gas users considered gas a safe fuel. Affordability and reliability are accorded greater priority than safety by low-income houses using gas. Only 54% of the users said that gas appliances were cheap, while 28% used gas because it was multi-purposeful (see Figure 5.5).

Paraffin continues to be used in formal houses. Of the 10% of the respondents who used paraffin for cooking, all said that they did so because it was cheap, 91% said that paraffin appliances are cheap, 82% said that it was quick, and 73% considered it multi-purposeful. Only 64% used paraffin because it was clean or reliable. Once again safety is not a priority. In fact, only 55% of users considered paraffin to be safe. The 10% of the sample are dependent on paraffin because they cannot afford electricity or electrical appliances, and they are trying to save on electricity (see Figure 5.5).

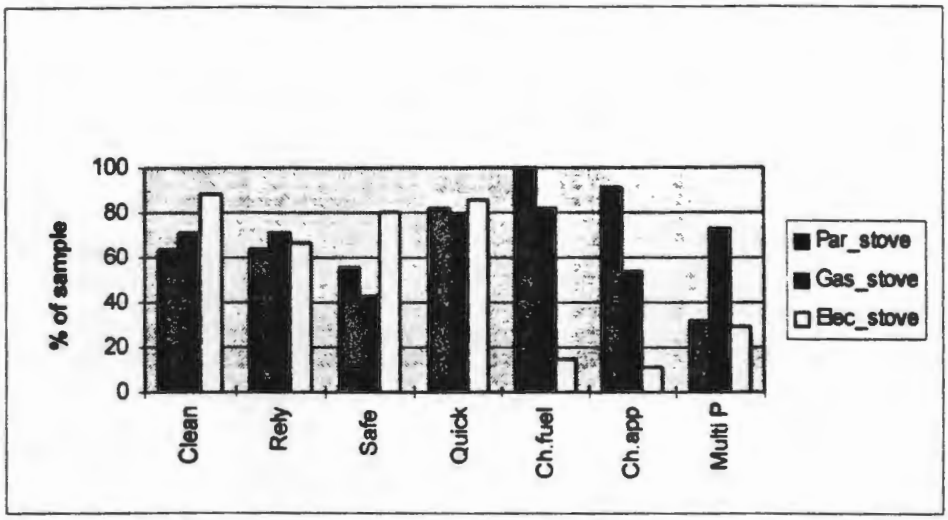

FIGURE 5.5 Reasons for using different fuel and appliance combination for cooking

5.2.2 Reheating foods

It is common that different fuels and appliance combinations are used for cooking and reheating food. As Table 5-3 reveals, electricity is used by more houses for reheating than cooking purposes. In formal houses, 71% of the residents used electricity to reheat food, followed by gas (17%), paraffin (5%) and other (7%). The 'other' category includes those respondents who did not answer, did not reheat food, had no leftovers or did not heat leftovers. So while fuels such as gas and paraffin are used to cook with, they are not necessarily used in reheating food. A possible explanation for this is that reheating food with electricity is perceived to be cheaper than cooking with electricity.

Type of fuel used in formal houses – Phase 4	Cooking food	Reheating food
Electricity	65%	71%
Gas	25%	17%
Paraffin	10%	5%

TABLE 5.3 Fuels used for cooking and reheating foods

5.2.3 Baking

Baking is energy intensive. Many female respondents stated that, while they would like to, they did not bake because it was too expensive. Of the sample, 23% respondents did not bake, while electricity was used by 55% of the sample that did bake. They used electric ovens, electric frying pans, paraffin stoves, gas stoves and pots with sealed lids. As one respondent explained 'I use the same pot that I use for cooking when I do the baking. I just smear it with fat and put the dough inside and put it on the stove on low heat'. Electric pans appear to be

popular because they can be used for stewing, roasting, cooking, baking and frying. Of the sample, 9% used gas and 4% used paraffin for baking (see Table 5-4).

Electricity	55%
Gas	9%
Paraffin	4%
Do not bake	23%
Other	9%

TABLE 5.4 Fuels used for baking

5.3. Refrigeration

[A] fridge has become a basic need for those with electricity – if you have a fridge you have food.

I always cook a lot of food and keep it in the fridge to avoid cooking everyday.

Refrigeration is an important end-use. Of the sample, 92% of the formal electrified households own refrigerators, 5% use their neighbour's fridge while 3% did not have access to a fridge. As shown in Table 5.6, the numbers of owners of electric refrigerators in Langa and Guguletu has been relatively constant throughout the phases. The number of electric refrigerators has increased in Phase 4 to 97%, 7% more than reported in Phase 3 (Thorne & Qangule 1994: 72). Figure 5.7 shows that there has been a slight decline in the ownership in electric refrigerators in Khayelitsha since Phase 3 (from 89% to 87%) and a slight increase in the ownership of gas fridges. The number of people using neighbours' refrigerators has remained constant.

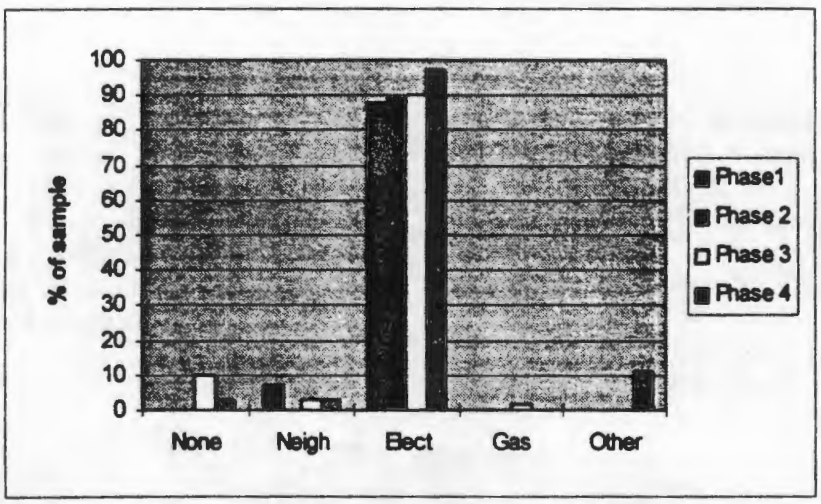

FIGURE 5.6 Refrigeration appliances for Langa and Guguletu

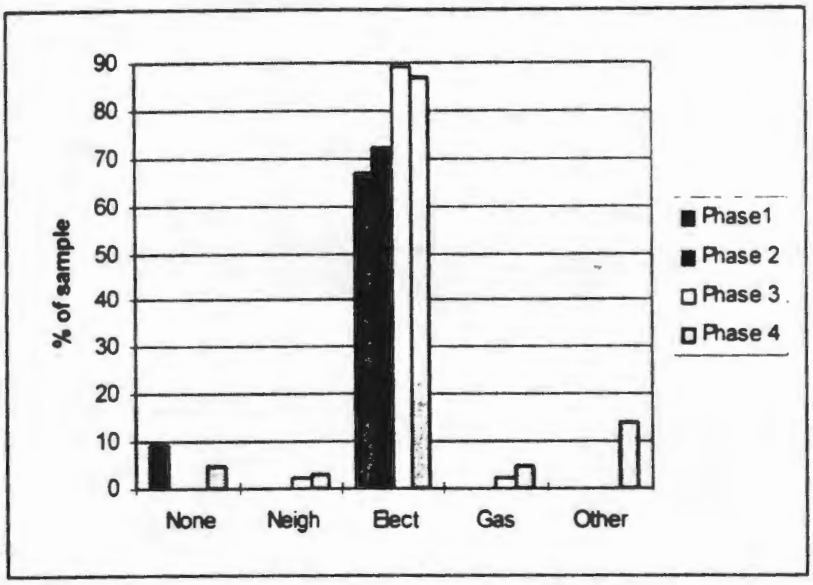

FIGURE 5.7 Refrigeration appliances for Khayelitsha

As highlighted in Figure 5.8, of the respondents who owned refrigerators, 86% owned electric refrigerators, 10% did not answer, 1% owned gas refrigerators, 1% used their neighbour's fridge and 2% fell into the 'other' category. The main reason for choosing an electric fridge was because it was safe (91%), clean (86%), and reliable (73%). Only 46% of the respondents found electricity 'cheap', and 9% said that they were using refrigerators because they were cheap.

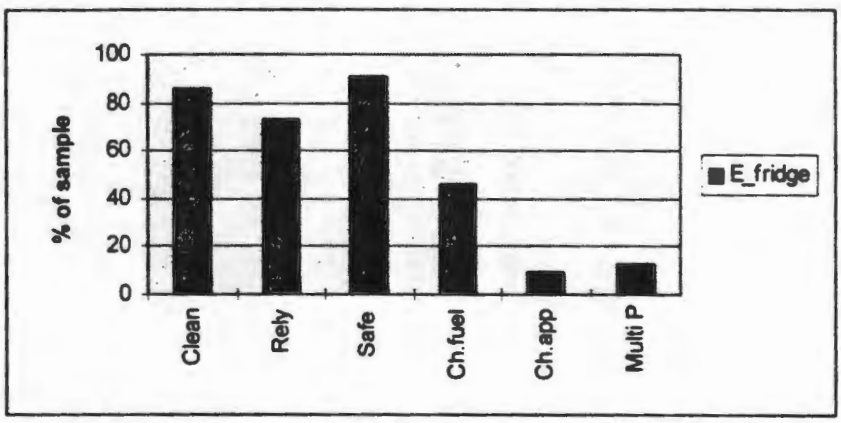

FIGURE 5.8 Reasons for choosing an electric fridge

5.4. Ironing

Ironing is a labour and time consuming task and could be energy intensive particularly if the appliances are inefficient. Of the total sample for formal households, 93% use electric irons. Phase 4 makes a distinction between a normal electric iron and an electric steam iron. Since this study tries to explore gender dynamics and energy preferences and patterns, it was assumed that electric irons (particularly steam irons) are 'women friendly' as they save time and energy. The distinction between steam and electric irons proved useful in the formal household sample where there are relatively more choices often than among informal households. The majority of formal houses use steam irons (83%), followed by electric irons (10%), flat irons (4%) and other (3%). The other category includes those that do not own an iron and/ borrow their neighbour's irons (see Figure 5.9). In Phase 3 it was reported that 96% of houses in Langa and Guguletu and Khayelitsha use electricity for ironing (Thorne & Qangule 1994: 70). In Phase 4 the ownership of steam irons is significantly higher than normal electric irons in Phase 3.

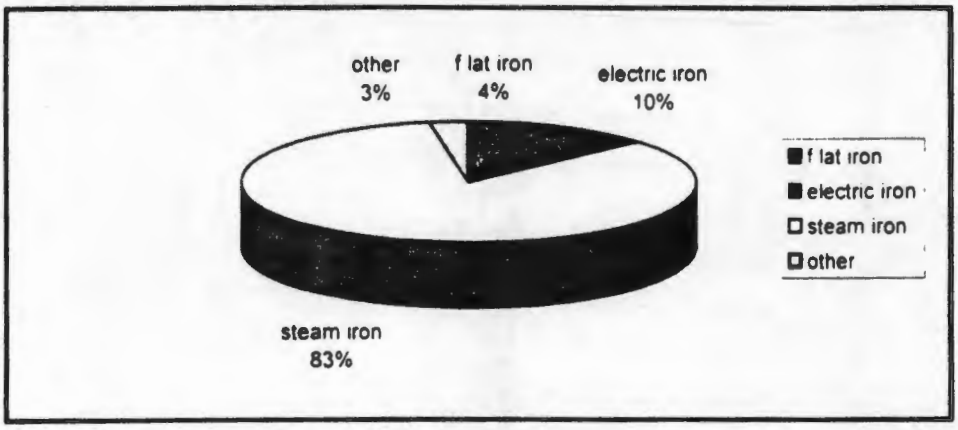

FIGURE 5.9 Type of iron used in formal houses

Respondents were asked why they used a particular fuel and appliance combination to meet their ironing needs. The nine respondents who owned electric irons said that they used it because it was clean (100%), reliable (89%) and safe (89%). These appear to be the main considerations for those respondents who used steam irons as well. In fact, 93% of the respondents said they used it because it was clean, 80% also said it was reliable and 92% said it was safe. Of these respondents only 12% found electricity affordable and regarded steam irons as cheap (see Figure 5.9). Additional reasons cited for using steam irons include that it was easier to use (13%); time saving (10%); does the ironing well (11%); self-dampening (7%). Flat irons rated low in terms of all the factors outlined.

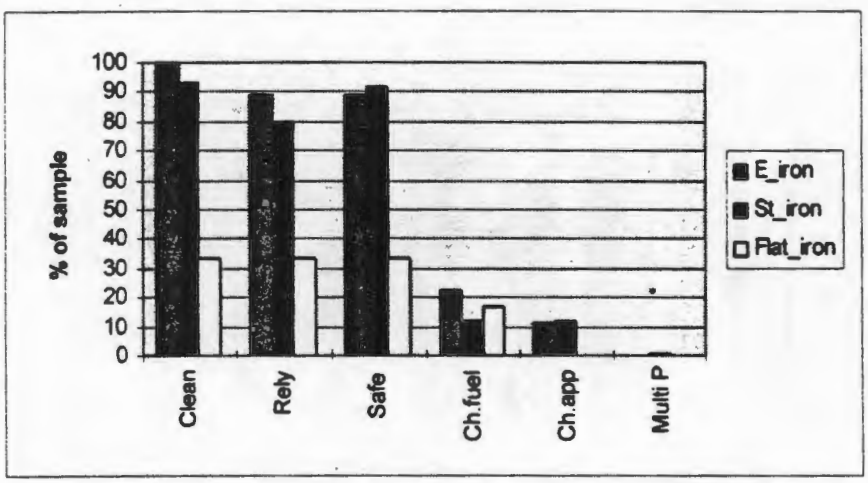

FIGURE 5.9 Reasons for different ironing methods in formal houses

The gender division of labour was more clearly defined for cooking than ironing. Of the formal sample, 51% did the ironing themselves while 'family members' did 34% of the ironing (both categories included men). As shown in Figure 5.10, of the respondents, 32% iron their clothing on a daily basis, while 26% iron on a weekly basis and 26% iron when clothes are needed.

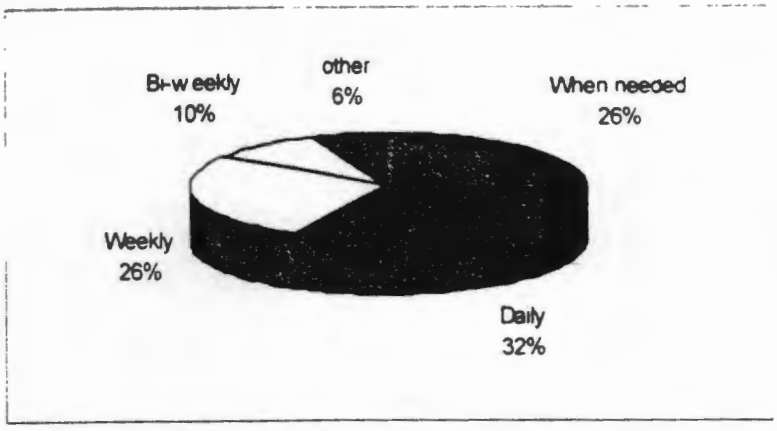

FIGURE 5.10 Frequency of ironing in formal houses

5.5. Space heating

> The paraffin heater is much better than the electric one [because] it makes the whole house warm unlike the electric one [which] warms in front of you.

Energy consumption patterns amongst low-income households vary between winter and summer months. As indicated in Figure 5.11, of the formal electrified sample, 14% of the houses did not own a heater and respondents were generally aware that electric heaters consumed a lot of electricity. They regarded heaters and electricity as expensive. In fact, only 43% of the sample owned electric heaters, 25% used paraffin heaters to warm their houses. Various strategies were used to keep warm:

- Using a paraffin stove to cook with while simultaneously heating the room – 14% of the respondents used this strategy in winter;
- Going to bed early and dressing warmly. `In winter we go to bed early and warm ourselves in bed'. `If kids feel that it is too cold for them they just go to bed and stay under the blankets to make them warm'. `We cover ourselves with blankets when it is cold';
- Alternating between fuels 'we use the paraffin heater when we do not have money-sometimes we use electric heater but very sparingly';
- Using electricity sparingly `Don't use it (electric heater) for a long time as it takes a lot of electricity. Try to use it when it is very cold. Use it in the evenings' .

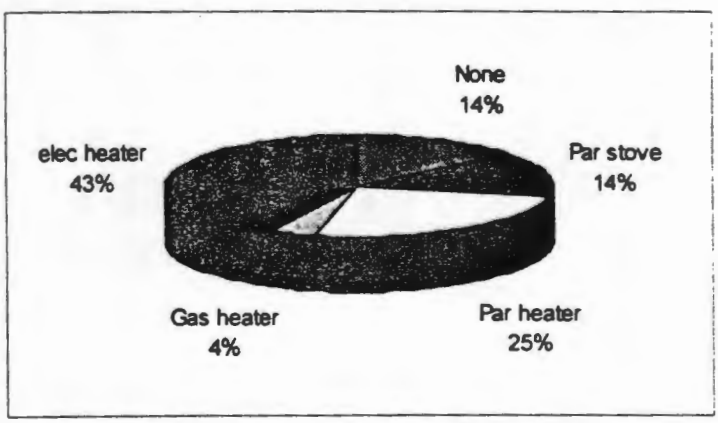

FIGURE 5.11 Space heating in formal houses

As highlighted in Figure 5.12, there has been a decline in the ownership of electric heaters in Khayelitsha from 70% reported in Phase 3 to 55% in Phase 4 (Thorne & Qangule 1994: 54). In Phase 1, 38% of the respondents had paraffin heaters but this figure dropped to 28% in Phase 3 to 29% in Phase 4. There was a decrease in the ownership of gas heaters from 8% in Phase 3 to 5% in Phase 4 (Thorne & Qangule 1994: 54). As shown in Figure 5.13, there was a decrease

in the ownership of all conventional space heating appliances including a steady decline in the ownership of electric heaters in Langa and Guguletu. This may be attributed to high electricity arrears and an attempt by residents to save on electricity. According to Thorne and Qangule (1994: 54), 50% of the respondents owned electric heaters in Phase 1, this fell to 26% in Phase 3, and in Phase 4 ownership was down to 22%. In Phase 1, 59% of the respondents owned paraffin heaters, but by Phase 2 ownership had dropped to 33% (Thorne & Qangule 1994: 54). There was a substantial increase in ownership of paraffin heaters in Phase 3 (57%) then but then dropped in Phase 4 to 24%. It is difficult to account for these fluctuations: it could be linked to the problems raised at the beginning of the chapter. The respondents who did not use heaters increased from 20% in Phase 3 to 51% in Phase 4. It is possible that some of these respondents were using paraffin stoves for heating purposes.

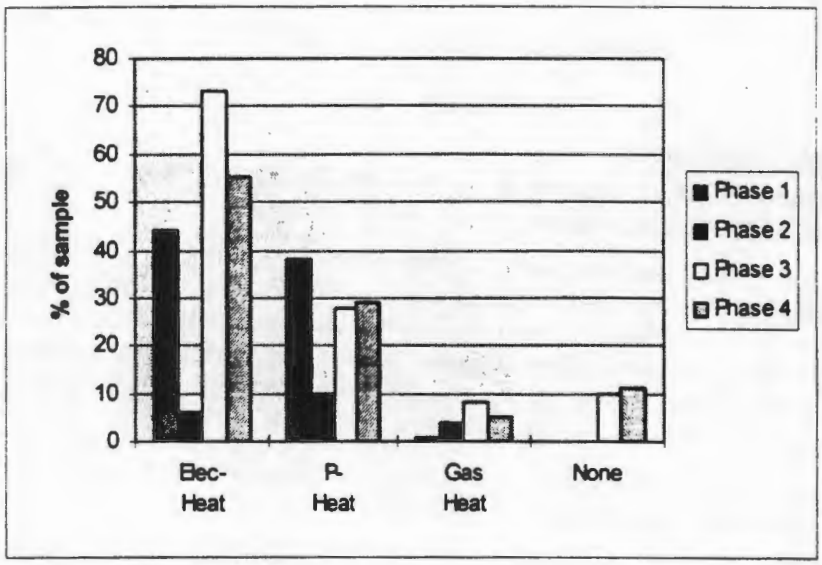

FIGURE 5.12 Space heating appliances – Khayelitsha

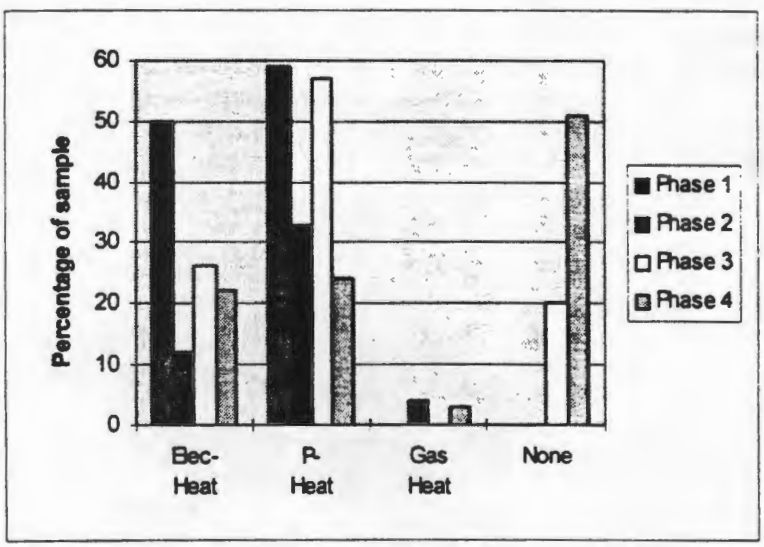

FIGURE 5.13 Space heating – Langa and Guguletu

Gas and electricity rate high in terms of cleanliness, reliability and safety. The two respondents who use gas for space heating claim that it is clean and reliable. Electric heaters are used because they are clean but only 61% said they use them because it is reliable. Once again this could be attributed to unreliable power supplies in these areas. Electricity (82%) is regarded as safer than gas (50%). Although paraffin heaters and stoves are used for space heating, they were not used because of cleanliness, reliability nor safety. In fact, only half the respondents regarded paraffin heaters as clean, 46% said it was reliable and 36% said it was

safe. Paraffin stoves were used by twelve of the respondents but only a third found it to be clean, reliable or safe. The respondents using paraffin heaters said they were using it because paraffin was cheap (75%), the appliance was cheap (61%) and it could be used for other activities (68%). In the case of paraffin stoves, 91% said they used it because the fuel was cheap, the appliance was cheap (75%) and it was multi-purposeful (58%). Only 8% of the 49 respondents who owned electric heaters used it because they found electricity to be cheap (see Figure 5.14) .

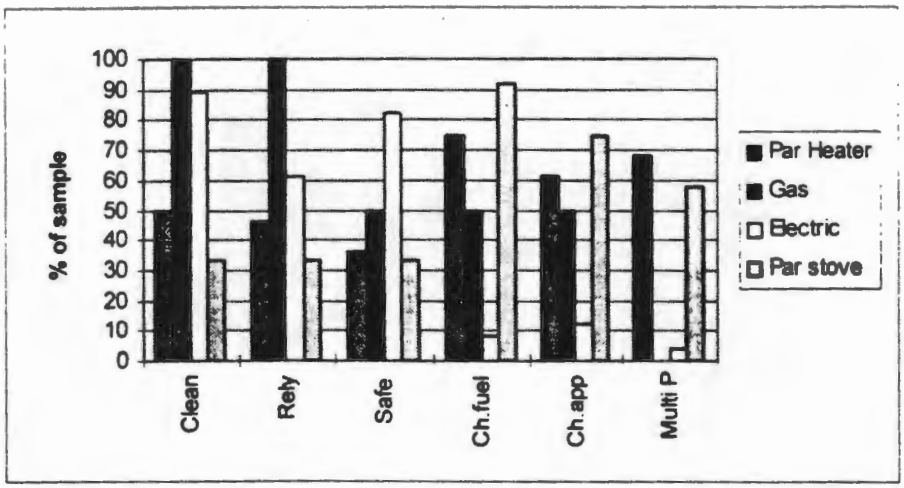

FIGURE 5.14 Reasons for using different methods of space heating in formal houses

5.6. Heating water for bathing

The use of electrical geysers has declined since Phase 3. Of the sample in Phase 4, 45% of the respondents used electric geysers compared to Phase 3 where 80% of the respondents used geysers (9% in Langa and Guguletu and 71% in Khayelitsha) (Thorne & Qangule 1994: 57-8). This decline could be a result of possible omissions on the respondents or fieldworkers. Those who own geysers are aware that it consumes a lot of electricity and some of the respondents switch it off when it is not in use. Electric kettles were the second most common way of heating water: 28% reported using this method. Of the sample, 15% heated water by using pots or kettles on electric stoves, 2% used electric urns, 5% used paraffin stoves and 5% used gas stoves (see Figure 5.15). The respondents appeared aware of energy efficient methods of water heating such as closing the lids on pots when boiling water.

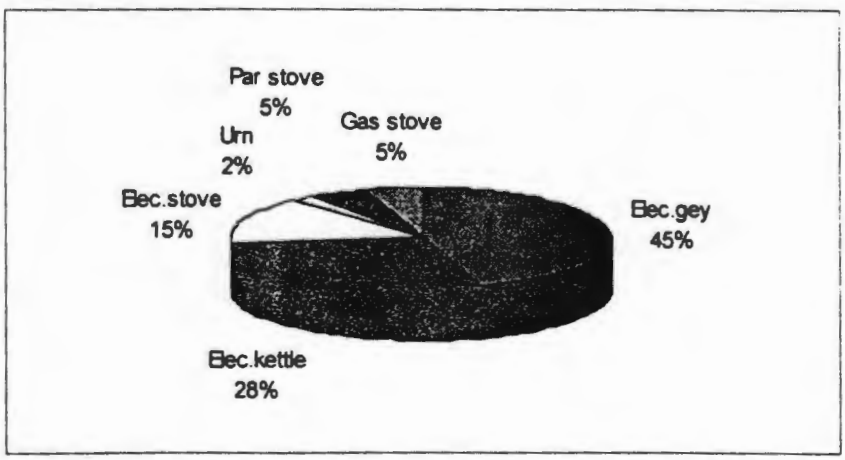

FIGURE 5.15 Heating water for bathing in formal houses

Respondents were asked if they were satisfied with the present system of water heating. Responses were mixed and confused: 48% said that they were satisfied with the present

system. Respondents who said this were those who had geysers or those who had no other choice; for example one of the respondents remarked 'So far satisfied, if not satisfied it would mean for us to save money for electricity. We won't afford a geyser with our financial position'. Furthermore, of the sample 21% said that they were not and that they wanted to upgrade the present system. 19% stated that they found geysers unaffordable, and 4% said that they were happy with the present system as it helped to save electricity (see Figure 5.16).

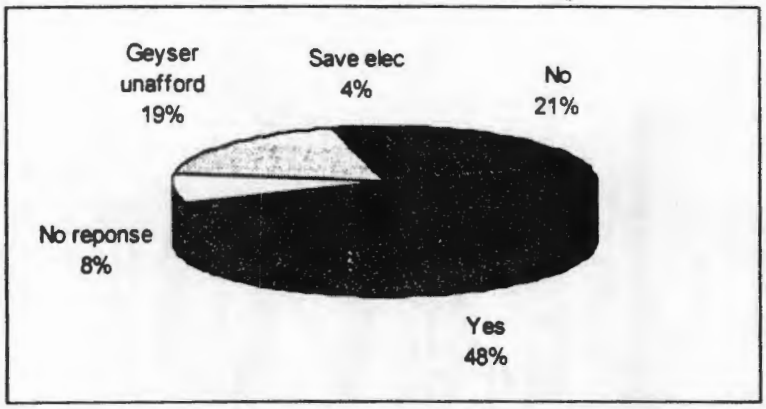

FIGURE 5.16 Satisfaction with present method of heating water in formal houses

5.7. Washing clothing

In low-income households very few people have washing machines and the majority wash their clothing by hand. Washing machines are generally expensive and this discourages people from buying them. However, washing machines are seen by a significant proportion of respondents, particularly women, as a basic need. Washing clothing by hand is labour and fuel intensive. Some of the concerns that were expressed by female respondents were:

> In winter it is not easy to do washing [since] the water is very cold.
>
> Will use the washing machine very soon – looking forward to comfortable way of washing. It will save a lot of time and my hands from washing. It is labour and time saving.
>
> Washing machine becoming a basic need for women especially single women like me who have to do every thing alone in the house.

As indicated in Figure 5.17, there has been an increase in ownership of washing machines in Langa and Guguletu since Phase 3 (from 10% to 19%). This explains the decline in hand washing from 84% to 79%. The high ownership of washing machines recorded during Phase 1 (36%) and the subsequent decline in Phase 3 and Phase 4 is difficult to explain (Thorne & Qangule 1994: 67). As indicated in Figure 5.18, a similar overall trend is evident in Khayelitsha where the ownership of machines has increased from 5% reported in Phase 1, to 3% in Phase 2, 10% in Phase 3 and 21% in Phase 4. There was a decrease in hand washing from 90% in Phase 3 to 79% in Phase 4 (Thorne & Qangule 1994: 67). The determinants for choosing a particular fuel and appliance combination for washing clothing were not explored in Phase 4.

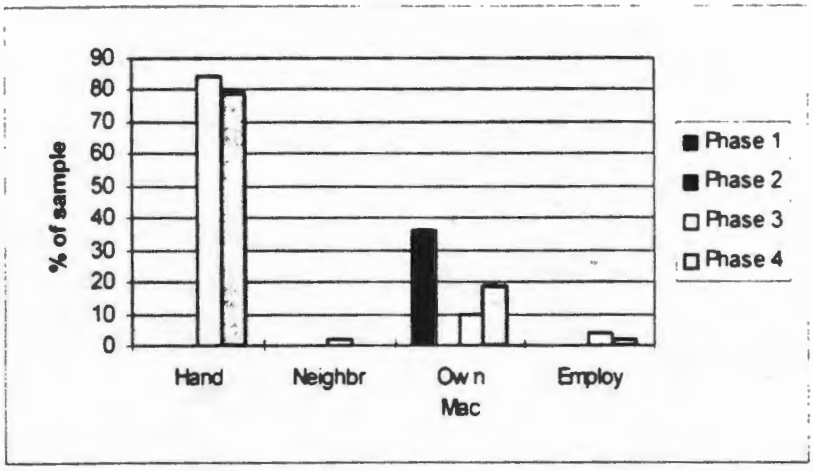

FIGURE 5.17 Method of washing clothes in Langa and Guguletu

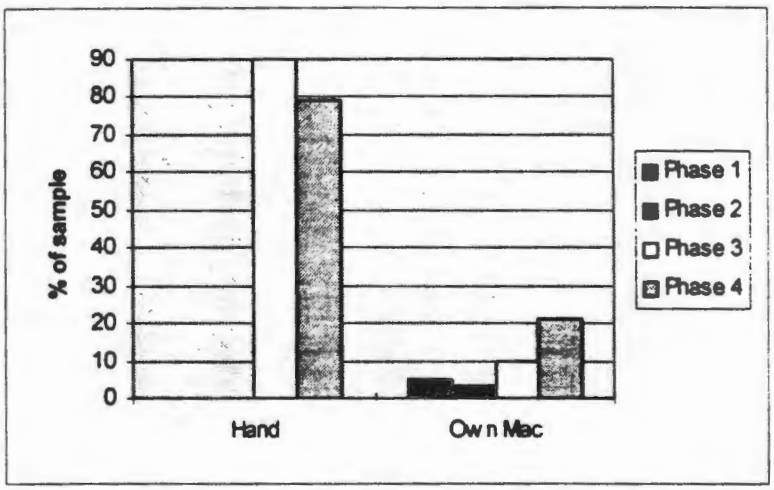

FIGURE 5.18 Method of washing clothes in Khayelitsha

5.8. Entertainment

There were some fluctuations in appliance ownership during the previous phases which are difficult to interpret. For example, while radio owners in Khayelitsha increased from 29% to 42% from Phase 1 to Phase 3 (Thorne & Qangule 1994: 63), Phase 4 experienced a drop to 30%. The ownership of televisions remained relatively constant over the various phases. Phase 1, 86% owned televisions and in Phase 2 increased to 92% (Thorne & Qangule 1994: 63). There has been a slight increase in the ownership of televisions since Phase 3 (from 90% to 92%). The ownership of video-recorders dropped from 23% in Phase 3 to 20%. There appears to be leveling off of hi-fi purchases in Phase 1 ownership was 63% but by Phase 3 ownership had fallen to 50%, and it rose once more to 62% (in Phase 4) (see Figure 5.19).

There were fluctuations in the ownership of radios in Langa and Guguletu as Figure 5.20 indicates. Ownership increased from 33% in Phase 1 to 68% in Phase 3 but declined to 48% in Phase 4. The ownership of hi-fis remained relatively constant over the years. In Phase 1 ownership was at 44%, in Phases 2 and 3 ownership at 39% but rose to 40% in Phase 4 (Thorne & Qangule 1994: 63). Televisions were the most commonly-owned entertainment appliance and the ownership has remained relatively constant: from 83% in Phase 1 to 88% in Phase 4.

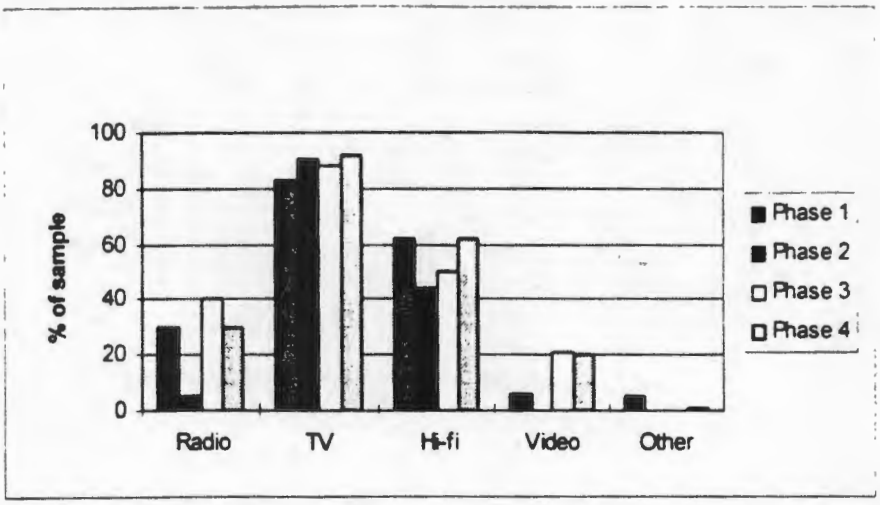

FIGURE 5.19 Entertainment `appliances' – Khayelitsha

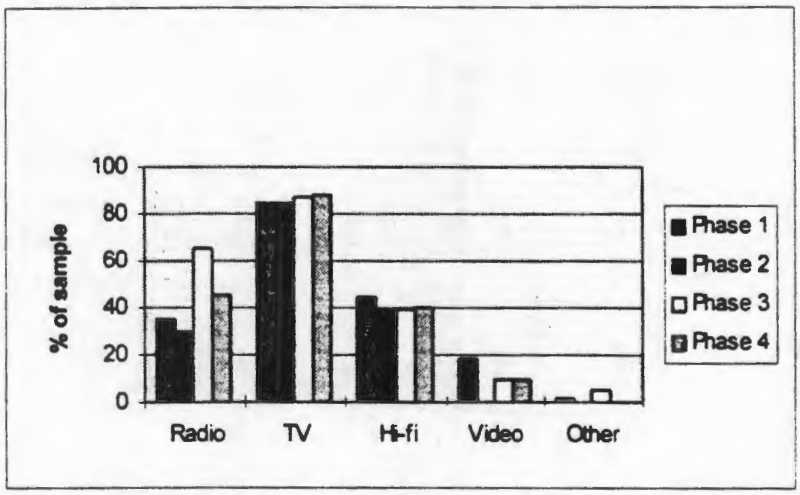

FIGURE 5.20 Entertainment `appliances' – Langa and Guguletu

While the reasons for using electricity for entertainment were not explored in Phase 4 it is likely that responses to this answer would be similar to the findings in Phase 3 `..Electrical appliances scored well in terms of cleanliness, reliability, safety and cheapness which rated between 68% and 84%. The cheapness of the fuel was the reason only given by 28% of the households' (Thorne & Qangule 1994: 66). It was difficult to determine the average number of hours that people spent watching television or listening to the radio as the question was open-ended and responses varied widely.

5.9. Lighting

This section examines: i) fuels used for lighting in formal homes on a daily basis; ii) fuels used for lighting in formal homes in emergencies; iii) lighting times for summer and winter; iv) the reliability of power supply; and v) causes of power failures.

Lighting is the immediate and affordable benefit associated with electricity both in terms of fuel cost and appliance. As Figure 5.21 indicates, electricity is used by 96% of the formal households for lighting, followed by gas (2%) and paraffin (2%). The type of lighting used in Khayelitsha and Langa and Guguletu was not compared with previous phases as the trends are similar (see Thorne & Qangule 1994: 61).

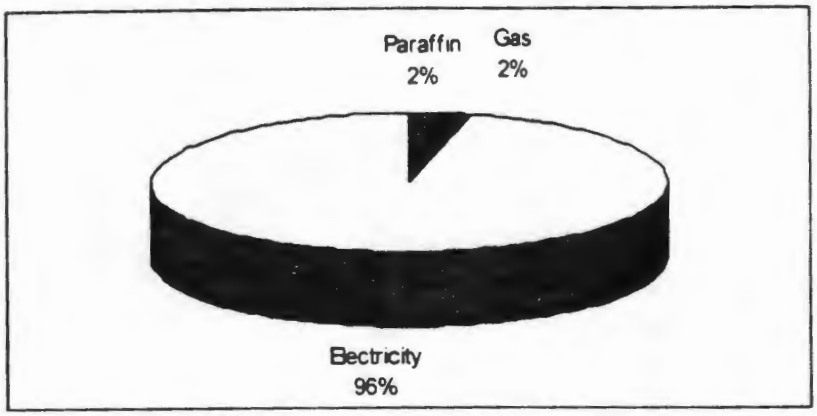

FIGURE 5.21 Fuel used for lighting in formal electrified houses

The majority of respondents used electricity for lighting. None of the respondents commented on the fluorescent light bulbs that were given to them in Phase 3. As highlighted in Figure 5.22, the reasons given for using electricity include its cleanliness (88%), reliability (80%), safety (91%), and multi-purposeful (5%). Only 21% of the respondents said that they used electricity because light bulbs were cheap, and 51% said they used electricity because it was cheap.

Gas lamps were used because they were clean (100%), reliable and convenient (100%) and also because they were safe (100%). Paraffin lanterns were used more because they were considered reliable and convenient (100%), safe (100%), and cheap (100%). Paraffin lamps were not considered clean nor were the appliances considered to be affordable.

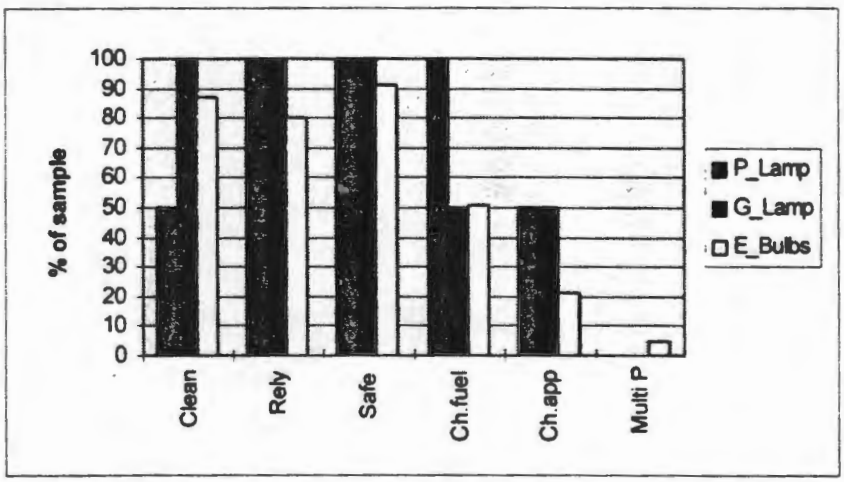

FIGURE 5.22 Reasons for using different methods for lighting on a daily basis in formal houses

5.9.1 Lighting in emergencies

This section explores the type of lighting used by formal houses in times of emergencies such as power failures. As Figure 5.23 illustrates, 64% of houses use candles during emergencies, while 32% use paraffin, 2% use gas and 2% fell into the 'other' category. The reasons given for using candles in emergencies varied and included personal preference, availability, cheap and familiar. Some of the reasons given for using paraffin include having a paraffin lantern and that it gives off a brighter light.

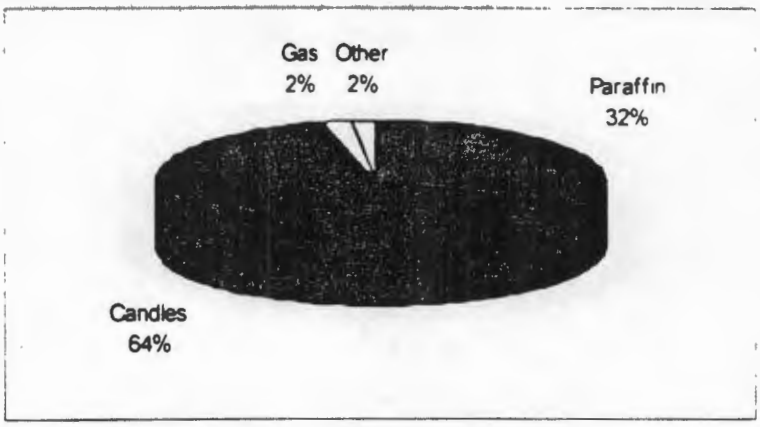

FIGURE 5.23 The type of fuel used for lighting in emergencies

The average number of hours that people use their lights as well as the peak periods are important factors in policy planning especially considering the introduction of tariff use. These change seasonally and differ amongst formal and informal houses. Generally, lights are used more in winter than in summer. Among formal houses in summer, lights are on average turned on for 2.8 hours. The peak time begins at 8 p.m. By contrast, formal houses on average use lights for 4 hours a day in winter.

The quality of power supply to both the formal and informal electrified areas appears to be poor. As indicated in Figure 5.24, only 9% of respondents in formal houses stated that power failures never occurred. The remainder experienced power failures in the past (11%); 12% said that they experienced this frequently, 7% said they experienced failures particularly in winter and during bad weather; others (25%) stated that it occurs sometimes; while 25% stated that it occurs rarely.

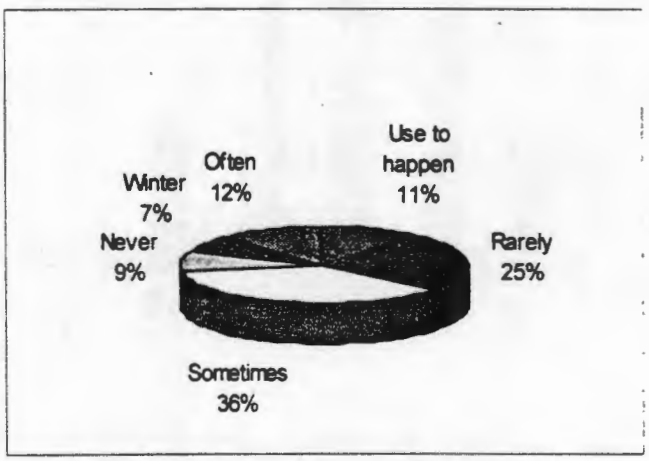

FIGURE 5.24 Rate of power failures in formal houses

The reasons given for power failures vary. In formal houses over a third of the respondents were unsure what causes power failures, 18% attributed it to the weather (and specifically to winter), 25% to poor maintenance, and 25% to vandalism. Other reasons included the electrification project in neighboring areas, accidents, tampering with boxes and faulty boxes.

5.9.2 Out of use appliances

As in Phase 3, respondents were asked about energy appliances that were out of order. SincePhase 3, the number of broken appliances had increased by over 50% (Thorne & Qangule, 1994:75). In total, 85 electrical appliances were reported as broken in Phase 4 (see Figure 5.25).

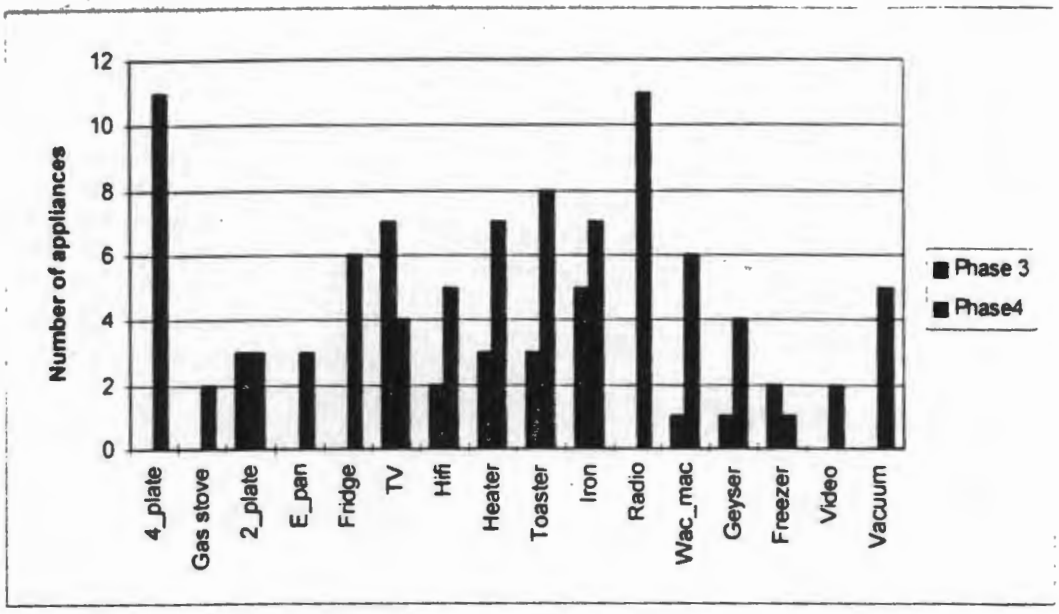

FIGURE 5.25 Out of use appliances in Langa, Guguletu and Khayelitsha for Phase 3 and Phase 4

5.10. Summary

Low-income formal electrified houses continue to engage in multiple fuel use. This may be attributed to many factors, including the lack of affordable electrical appliances, the perception that it is more expensive to use electricity and the fact that socio-economic situation does not allow households to use electricity for all end-uses. Instead, electricity is used mostly for media (97%), lighting (96%), refrigeration (90%) and ironing (93%). It is also used by 65% of the respondents for cooking; 43% for heating water (electric geysers); 43% use it for space heating, while the 22% who own washing machines use it for laundry. The electrical supply to these three areas seem very unreliable and only 9% of the respondentss stated that power failures never happen. This poor electricity supply contributes to multiple fuel use.

The prepayment meter system was inroduced to ensure that people pay upfront for electricity and to help them budget. However, this system may dissuade people from using electricity for all end-uses as they become increasingly aware of the cost attached to each end-use. In this manner the prepayment systems can have 'gendered' impacts on its users, as it is cheaper, for example, to use electricity for lighting and media than it is for cooking or ironing. Women, who are generally responsible for household resource management, must be cautious about energy consumption and must find cheaper and sometimes less efficient ways of completing their tasks.

Low-income households seem to spend the most on prepayment electricity, followed by credit meters, gas and paraffin. In fact, almost 44% of the respondents spend between R45 and R100 per month on electricity prepayment meter cards. Of the respondents who have prepayment meters, *only* 43% use electricity to fulfil all their energy end-uses. Paraffin and gas purchases are bought in smaller amounts. Almost 23% of the formal electrified houses spend an average R15 to R25 paraffin. Gas is more popular than paraffin in low-income formal electrified households. The monthly expenditure on gas ranges between R8 to R65, however majority of the households seem to spend between R5 and R15.

Women (94%) did most of the cooking in formal houses. Of the repondents, 65% used electricity to cook with, 10% used paraffin and 25% used gas. This does not capture multiple fuels used for cooking diferent dishes nor the different fuels used at different times of the month or year.

Langa, Guguletu and Khayelitsha seem to be using less electricity for energy intensive activities such as cooking and space heating. Gas is beginning to be used more frequently for cooking. Gas appliances are used by over a third of the respondents in Langa and Guguletu for daily cooking, while paraffin appliances are used by almost a third of them. The range of

appliances and fuels used in Langa and Guguletu could be explained as an attempt to save electricity in the context of arrears, or impending power cuts. It is also possible that some users have had prepayment meters installed and are becoming aware of the costs attached to each energy service.

The use of hot-plates for daily cooking in Khayelitsha has decreased since the beginning of the study. In Phase 1, 40% of the sample owned hot plates, but by Phase 3 and 4 it had dropped to 22%. There was an increase in the use of 4-plate stoves in Khayelitsha: from 46% in Phase 1 to 68% in Phase 3. In Phase 4, there was a 12% decline in the use of 4-plate stoves and only 53% of the respondents reported using their stoves on a daily basis. This might be explained by appliances being out of use or by the perception that it is more expensive to cook with electricity than with other fuels. Gas stoves are increasingly popular in Khayelitsha: the use of gas for cooking increased from 20% in Phase 3 to 31% in Phase 4).

The use of 2-plate electric stoves in Langa and Guguletu appears to have remained constant but there has been a sharp decline in the use of 4-plate electric stoves (from 79% in Phase 3 to 68% in Phase 4). There has been an increase in the use of electric-frying pans from 10% in Phase 3 to 27% in Phase 4. A possible explanation for the decline in the use of electric stoves is the arrears situation and an attempt to save electricity. Frying pans are replacing electric stoves mainly because they are multi-purposeful, convenient and seen as consuming less electricity. In Phase 1 none of the respondents were using gas stoves. There has been a dramatic increase in the use of gas stoves to 38% in Phase 4.

Among the 65% electricity users, the main reasons given for using electricity for cooking were because it is clean (88%), quick (85%) and safe (80%). It seems as if electricity was used more because of convenience rather than affordability. Only 15% of the respondents used electricity because it was cheap and 11% found electrical appliances to be inexpensive. Only 66% of the respondents said that they used electricity because it was reliable. This means that the reliability of electricity is not an issue or that the electricity supply is unreliable. The reasons given for using gas for cooking were that it was cheap (82%), clean (71%), and quick (79%).

It is interesting to note that 71% of the respondents stated that they used gas because it was reliable. However, gas is seen to be dangerous: only 43% of gas users considered gas a safe fuel. Affordability and reliability are accorded greater priority than safety by low-income houses using gas. Only 54% of the users said that gas appliances were cheap, while 28% used gas because it was multi-purposeful. Of the 10% of the respondents who used paraffin for cooking, all said that they did so because it was cheap, 91% said that paraffin appliances are cheap, 82% said that it was quick, and 73% considered it multi-purposeful. Only 64% used paraffin because it was clean or reliable. Only 55% of users considered paraffin to be safe. The 10% of the sample are dependent on paraffin because they cannot afford electricity or electrical appliances, and they are trying to save on electricity.

The number of refrigeraters has increased over the four phases. During the first three phases the number of electric refrigerators owned in Langa and Guguletu remained relatively constant (90%) and there was an slight increase of 7% in Phase 4. In Khayelitsha there was an increase in ownership of electric fridges since Phase 1 from 67% to 87% in Phase 4.

There has been a steady increase in the ownership of electrical irons in Langa, Guguletu and Khayelitsha. Phase 4 differenciated between an ordinary electric iron and a electric steam iron as the latter are more women friendly as they save time and energy. The majority of formal houses use steam irons (83%), followed by electric irons (10%). The ownership of washing machines in Khayelitsha has increased from 5% in Phase 1, to 10% in Phase 3, to 21% in Phase 4. In Langa and Guguletu there was a decrease in ownership of washing machines from 36% in Phase 1; 10% in Phase 3 to 10% in Phase 4.

There has been an overall decrease in the ownership of electric heaters since the beginning of this study. In Phase 1, 50% of the respondents in Khayelitsha owned electric heaters, this increased to 70% in Phase 3 but declined to 55% in Phase 4. The ownership of paraffin heaters (29%) remained constant for the last two phases. There has been a slight decrease in the ownership of electric heaters in Langa and Guguletu from 50% in Phase 1, to 26% in Phase 3 to 22% in Phase 4. This decline in ownership of electric heaters may be attributed to the high arrears residents face and an attempt by residents to save on electricity. The ownership of paraffin heater has also dropped from 59% in Phase 1 to 24% in Phase 4. Households which do not use any space heating appliances have risen from 20% in Phase 3 to 51% in Phase 4.

The use of electrical geysers has declined since Phase 3. Of the sample in Phase 4, 43% of the respondents used electric geysers compared to Phase 3 where 80% of the respondents owned geysers (9% in Langa and Guguletu and 71% in Khayelitsha). This could be a result of a possible omission on the respondent or fieldworker's behalf. Electric kettles were the second most common way of heating water: 28% reported using this method.

There were some fluctuations in ownership of entertainment appliances. In Khayelitsha, ownership of televisions remained relatively constant over the various phases. In Phase 1, 86% owned televisions and this increased to 92% in Phase 4. The ownership of video-recorders has also remained constant- from 23% in Phase 3 to 20% in Phase 4. There appears to be leveling off of hi-fi purchases in Phase 1 ownership was 63% but by Phase 3 ownership had fallen to 50%, and it rose once more to 62% in Phase 4. There were fluctuations in the ownership of radios in Langa and Guguletu. Ownership increased from 33% in Phase 1 to 68% in Phase 3 but declined to 48% in Phase 4. The ownership of hi-fis remained relatively constant over the years. In Phase 1 ownership was at 44% and dropped to 40% in Phase 4. Televisions were the most commonly-owned entertainment appliance and the ownership has remained relatively constant: from 83% in Phase 1 to 88% in Phase 4.

Energy services in informal houses

> Electricity is the only way of living. If you have electricity you have everything.
>
> Electricity is the best way of living – although I have not got it for a long time but I can see that can rely on it.
>
> Paraffin is much easier to use – because you can spend a whole day using one bottle.

In Phase 4, thirty-three newly electrified, informal houses from Site B in Khayelitsha were added to the sample. While, the informal household sample is too small to be representative of the settlement, it gives an indication of energy consumption patterns in low-income informal houses. Further, it provides an interesting comparison of consumption patterns between formal electrified houses and informal, site and service houses. This chapter explores the manner in which respondents in newly electrified low-income informal houses meet their energy requirements. It examines: i) the energy end use services that are fulfilled by electricity; ii) the appliance and fuel combination used to fulfill the different energy needs and services including cooking, refrigeration, ironing, space heating, water heating, entertainment and lighting; and iii) the determinants (that is, the cleanliness, reliability and convenience, affordability, appliances and fuels, safety and multiple use) that shape households' fuel and appliance combination; and finally it compares the determinants of formal electrified homes to that of informal electrified houses.

Energy consumption in these informal houses is influenced by, amongst other things, household structure (usually corrugated iron walls and earth or cement floors), income, household size and decision-making practices in the family, climate, accessibility and reliability of fuel, and affordability of appliances. Eskom has embarked on a nationwide programme to electrify these structures through prepayment meter and ready boards. While the basic cost of electrifying each house is approximately R2000, electricity consumption is low – with newly electrified households consuming an average of R10 to R20 a month. However, to assume that low-income informal houses require only a prescribed voltage ignores the obstacles to greater electricity consumption. In fact, it may be that households with access to electricity would, in most instances, want to use electricity for all end uses but are prevented from doing so for a variety of reasons. Research should therefore focus on understanding these reasons, and policy interventions need to make electricity *and* electrical appliances more accessible and affordable.

6.1. Electricity end uses in informal electrified houses

The transition to electricity use in low-income households in informal houses has been relatively slow. As indicated in Figure 6.1, electricity is not used for all end uses – instead it is used mostly for lighting (97%) and media/entertainment (79%). These are the most common end uses and are generally the most affordable as they require little appliance investment. People already own televisions and radios which previously ran on batteries.

Of the sample, only 30% used electricity to heat water for bathing; followed by 24% who used it for ironing; 27% for refrigeration; 17% for cooking; 15% for reheating food; 9% for space heating; and 6% for baking (see Figure 6.1). Generally, other fuels are used because electricity is relatively expensive or electrical appliances are unaffordable, amongst other things.

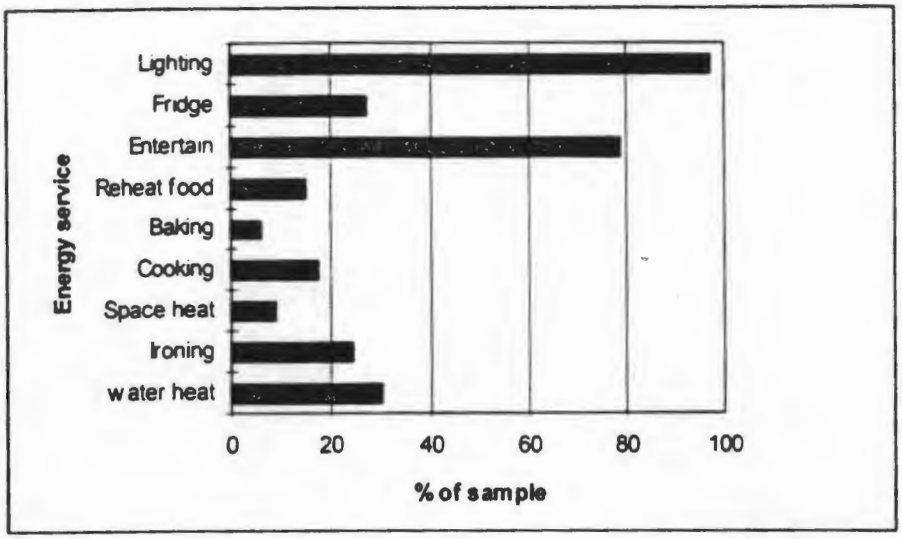

FIGURE 6.1 Use of electricity in informal houses

6.2. Monthly expenditure on fuel

The majority of electrified, informal homes continue to engage in multiple fuel use. In fact, only four newly electrified homes used electricity for all end-uses. Figure 6.2 outlines the monthly fuel expenditure of these households. Amongst the sample, paraffin (79%), prepayment card electricity (88%) and gas (18%) were the most commonly used fuels. Wood was used by one of the respondents (3%). Most of the fuels bought by these low-income informal houses are concentrated in the lower expenditure categories. For example, over two thirds (64%) of the respondents spend between R0 – R5 and R15 – R25 a month on electricity cards. The majority of the respondents (68%) monthly paraffin purchases ranged between R5 – R15 to R25 – R35. The monthly expenditure for gas varied and included purchases for R5 – R15 and R25 – R35. Fuel use is closely linked with household's socio-economic position. This is reinforced by the fact that majority of these households do not buy in bulk but instead buy fuels in small quantities as the immediate cost is less.

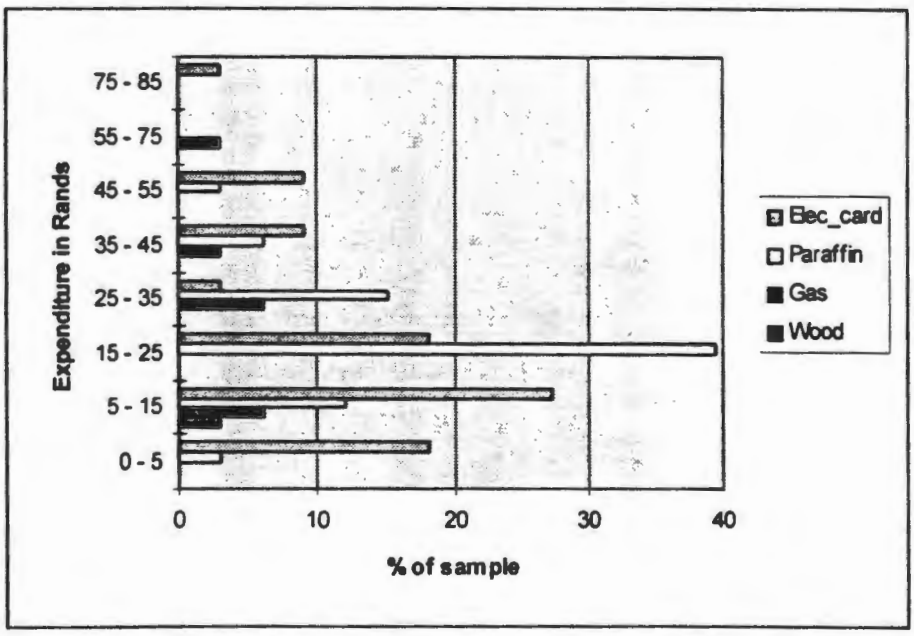

FIGURE 6.2 Monthly fuel expenditure in informal houses

6.3. Cooking

> Elec[tricity] is the best. Your house stays neat and clean and you feel safe and secure unlike when you are using paraffin. – *Female respondent*
>
> Electricity is quicker than paraffin. Much labour is involved and it takes a long time to cook. – *Female respondent*
>
> Five litres of paraffin lasts a whole week. – *Female respondent on budgetting of fuels*

The question 'Who does the cooking?' was posed to respondents in the informal houses. Of the 33 households interviewed, women did all the cooking. Cooking is a time consuming activity which is also energy intensive. Low-income households deliberately engage in multiple fuel use to save electricity. Users and managers of household resources who keep a close check on fuel use and expenditure are hesitant to use electricity as they feel they have less control over it. By contrast, women know that it takes one litre of paraffin to cook a pot of samp. While prepayment meters may educate users on the cost of electricity use and therefore help them to budget effectively, they may deter users from becoming too dependent on electricity.

To understand multiple fuel practices, the questions 'What appliance do you use for daily cooking?' and 'What fuel do you use for daily cooking?' were posed. These questions allowed for multiple answers, confused and contradictory answers that were difficult to interpret. Ownership of electrical appliances amongst informal households is generally low. Two-plate stoves, electric pans and electric toasters were the most commonly owned. Of the respondents, 6% owned four-plate electric stoves and 20% owned two-plate electric stoves. Of the sample, 22% owned gas stoves and approximately two-thirds (70%) owned paraffin stoves (both primus and flame stoves). In addition, 9% owned electric toasters and another 9% owned electric pans (see Figure 6.3). Two-plate electric stoves appear more popular as it is relatively more affordable and takes up less space than a four-plate stove. Nevertheless, many of the female respondents indicated that they would like to purchase a four-plate electrical stove mainly because these stoves saved time as the bigger surfaces allowed for different dishes to be cooked simultaneously. These stoves could also be used to heat water for bathing purposes and baking.

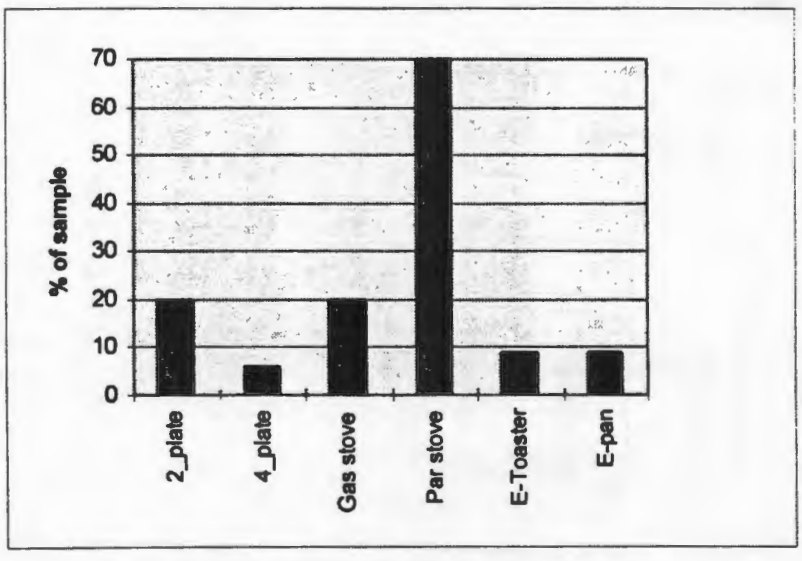

FIGURE 6.3 Cooking appliances in informal houses

6.3.1 Fuel and appliance used for daily cooking

As Figure 6.4 indicates, only 17% of the respondents in informal electrified houses use electricity for daily cooking: 11% use 2-plate electric stoves, 3% use 4-plate stoves and 3% use electric frying pans. The majority of the respondents (61%) use paraffin for daily cooking (36% use primus stoves and 25% use flame stoves). Most of the women use one-plate paraffin stoves or the gas stoves to cook with. This implies that cooking and/heating water has to be

done in stages or, otherwise through a combination of fuels and appliances. This is one of the reason why households own a variety of cooking appliances.

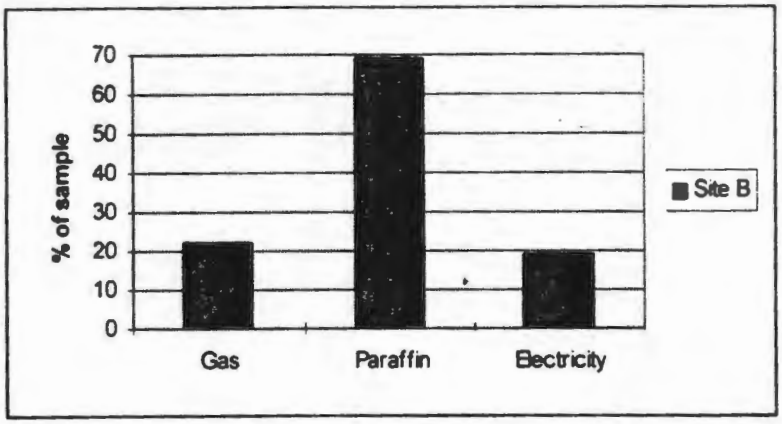

FIGURE 6.4 Fuels used on a daily basis in informal houses

Respondents were asked why they chose particular fuel and appliance combination to meet their cooking needs. The most common reasons given for using paraffin (primus) stoves were that the fuel was cheap, the appliance was cheap, it was quick and multi-purpose. Only a few respondents said that they used the primus stove because it was safe (13%) (in fact, they were using it because of limited choices). Only 25% used primus stoves because they were reliable, and 50% of those using primus stoves said they used it because it was clean.

Of the nine respondents using gas, all said they used it because it was clean, reliable, and quick, 78% believed that gas was safe and 89% of the respondents found gas and gas appliances cheap, and 67% used gas because it was multi-purposeful. Of the 9% using electricity, all said they used it because it was clean, reliable, safe, quick and none considered electricity cheap. One-third considered electrical appliances to be cheap and only a third considered electricity to be multi-purposeful (see Figure 6.5).

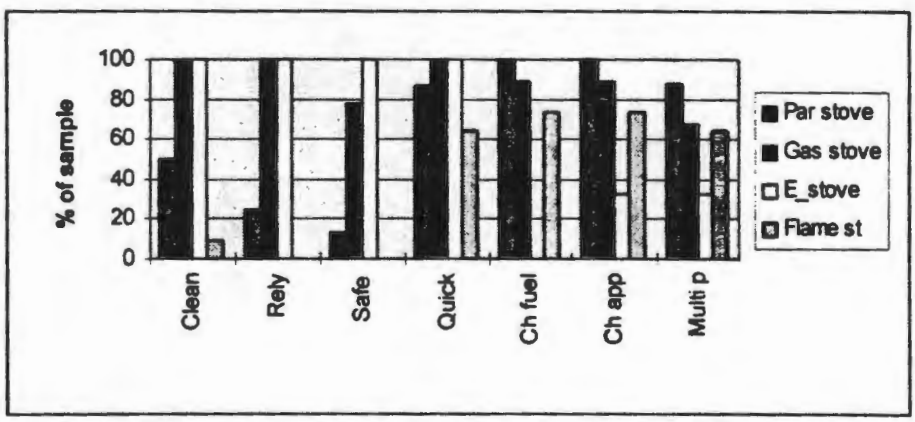

FIGURE 6.5 Reasons for using different cooking methods in informal houses

In comparing formal and informal homes, it was found that respondents in formal houses regard cleanliness, speed, safety, and reliability as important considerations when determining fuel and appliance combination. By contrast, informal houses consider cheap fuel, cheap appliance, and the multi-purpose use of fuel and appliance as important. Respondents in both formal and informal prefer to cook with fuels that are quick (see Figure 6.6).

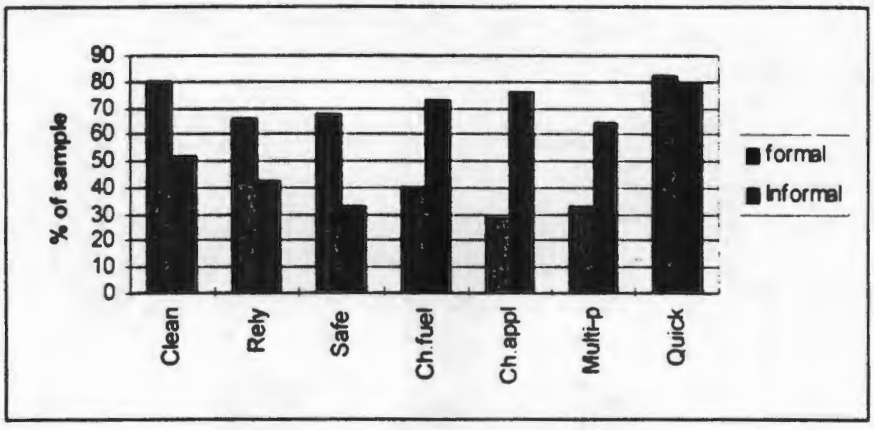

FIGURE 6.6 Fuel and appliances used for cooking

6.3.2 Reheating food

Most residents (67%) in the informal houses used paraffin to reheat their food, 15% used gas and 15% used electricity and 3% did not respond (see Figure 6.7). As Table 6-1 shows, If these trends are compared to fuel used for cooking, it seems that gas and electricity are used to cook with, but seldom used to reheat food. People perceive that it is cheaper to reheat food with paraffin.

Fuel type	% for cooking	% for reh
Paraffin	63	67
Gas	20	15
Electricity	18	15

TABLE 6.1

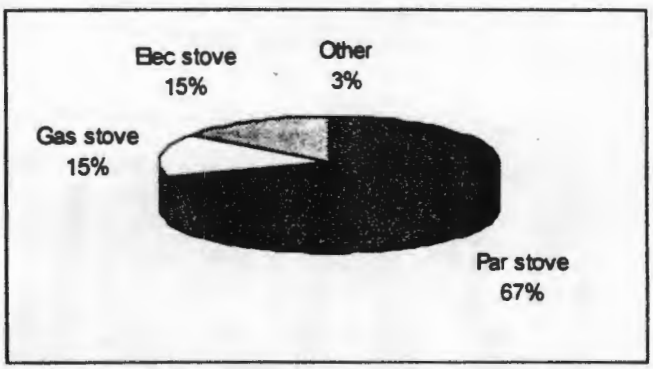

FIGURE 6.7 Reheating food – informal houses

6.3.3 Baking

> I use the flame stove to bake with. I put the zinc on top of the flame stove and on top of the zinc put the sand...the sand will act as an oven because it will keep the warmth. Then I use the same pot we use when we cook for baking.

Baking is not significant in the diets of low-income households but, as Annecke (1993: 51) argues, it is an important part of the way women understand their role as providers and mothers. In formal houses, electricity is used by the majority (55%) for baking, while in informal houses paraffin is more widely used (58%). Of the total sample, 21% of the respondents in informal houses and 23% in formal houses said they do not bake. Only 6% of respondents in informal houses used electricity for baking purposes and 6% used gas. Of the formal household sample, 4% used paraffin and 9% used gas for baking (the 'other' category refers to those who bake at family and friends and those who did not answer) (see Figure 6.8).

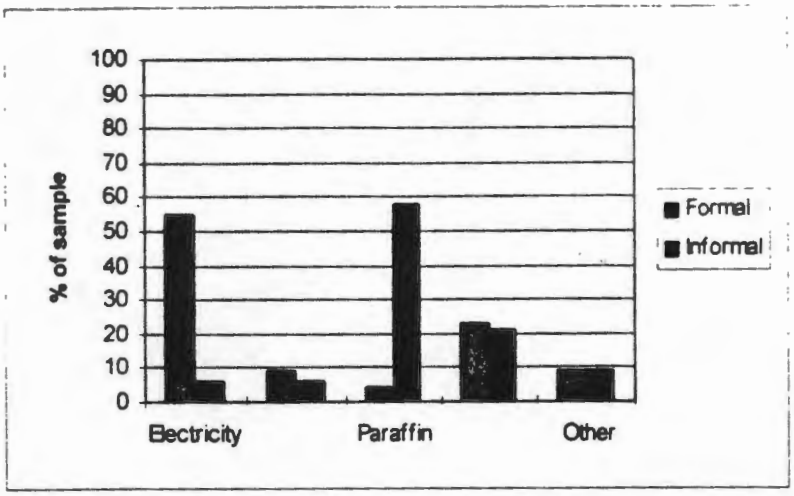

FIGURE 6.8 Fuels used for baking

6.4. Refrigeration

Refrigeration is an important end-use. Most low-income households, especially those in the informal sector, do not have refrigerators as they are expensive. While refrigeration is generally considered a 'luxury' it would enable poor households to bulk buy (thereby saving money), store leftovers and preserve foods. Lack of refrigeration, in fact, has a cost and women are forced to cook daily. Lack of refrigeration also affects diets as people are forced to rely on canned, ready-made and processed foods. Fridges, therefore, are 'women friendly' appliances as they would permit better management of time, labour and resources. According to many female respondents, owning a fridge implies they don't have to cook on a daily basis: ` I always cook a lot of food and keep it in the fridge to avoid cooking everyday'. As Figure 6.9 indicates, of the sample for the informal houses, 18% of the respondents own fridges, 73% do not have fridges, and 9% share fridges with their neighbours.

Households that do not have fridges depend on their neighbours' fridge or adapt their diets seasonally since some foods (meat, for example) lasts longer in winter. One respondent explained `As we are not having a fridge we do not buy meat in bulk. Instead we first buy the meat only when we are doing the cooking but in winter it is better because even if you can buy the meat in bulk it is not easy become rotten because it's too cold. Sometimes we buy more tin stuff.'

Lack of storage space and refrigeration prevents households from buying or cooking in bulk. The result is that poor households end up spending more of their budget on food and fuel. They also use various coping strategies. According to one respondent `As we got no fridge we buy meat only when we know that we will cook'. Other respondents stated `As we got no fridge we buy the meat when we know we are in need – and it is only that time. We do not cook more food because we do not want leftovers'; `Since we got no fridge we buy meat on credit from the hawkers and we pay them monthly. But most of the time we buy tin stuff and if we get leftovers we just fill a pot with water and put the dish that has got the food inside the pot that has got the cold water'.

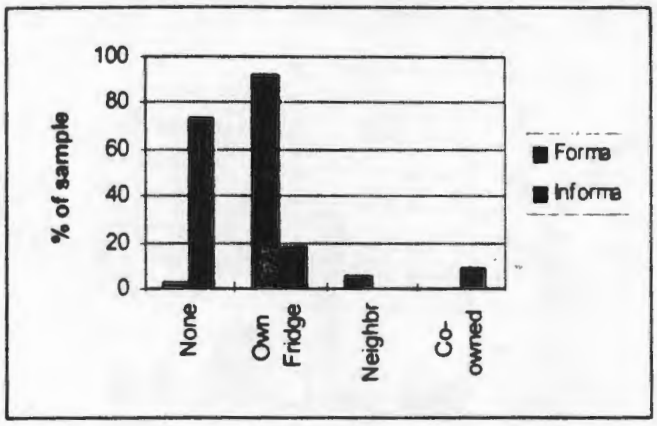

FIGURE 6.9 Refrigeration

6.5. Ironing

Using a flat iron on a daily basis is tedious and time consuming.

It [a flat iron] is the only appliance I own and only appliance I am used to.

Most (78%) of informal houses use flat irons which makes ironing energy and labour intensive; 19% use steam irons; and 3% use the conventional electric irons. Steam irons, despite being more expensive, are more popular than electric irons. Flat irons are used mainly because it is the only appliance that a household owns and they could not afford anything else, or because it was the only system with which they were familiar. Of the informal households using flat irons, 36% use a paraffin stove to heat the iron (36%), 9% use a gas stove (9%) and 3% use an electric stove (3%).

Respondents were asked why they chose particular fuel and appliance combinations for ironing. Those respondents who used steam irons and electric irons said they were clean, reliable, convenient and safe. (It is interesting to note that the cost of the appliance and fuel were not *the* determining factors). By contrast, for those who use flats irons, the reasons were that the appliance and fuel were cheap (see Figure 6.10).

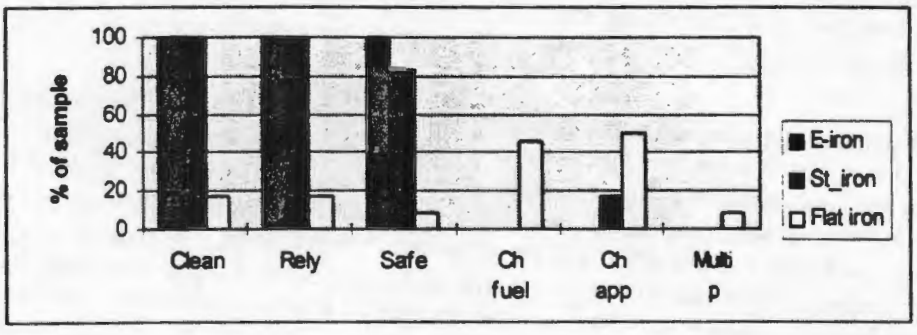

FIGURE 6.10 Reasons for fuel and appliance combination for ironing in informal houses

The reasons for choosing particular fuel and appliance combinations for ironing differ between formal and informal houses. Cleanliness, safety, and reliability of the fuel and appliance were determining criteria for formal households. Amongst informal houses, cheap fuel, cheap appliance, reliability were the main considerations (see Figure 6.11).

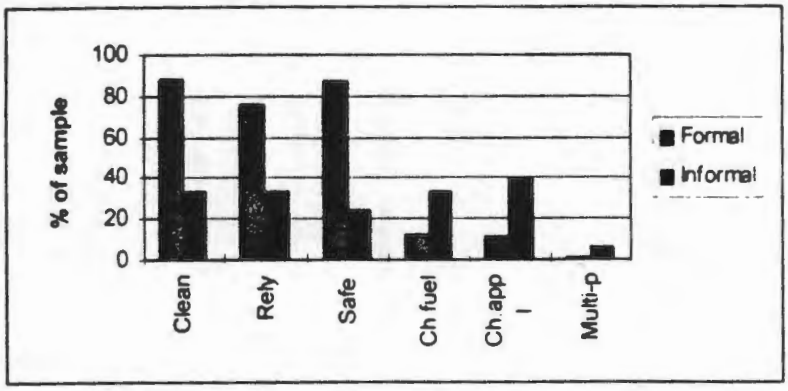

FIGURE 6.11 Fuel and appliance for ironing

The question 'Who does the ironing?' was posed to the respondents. It was found that women were primarily responsible for ironing in both formal and informal houses (61%). It is interesting to note that of the 17 males interviewed only four (24%) did the ironing. 'Family members' were not disaggregated. The remainder of the ironing was done by family members (34%) which was not disaggregated along gender lines.

Most (58%) of the respondents ironed on a daily basis and this can largely be attributed to the lack of storage and hanging space. Of the remaining respondents (15%) ironed twice a week, weekly (18%) and when needed (3%).

6.6. Space heating

Space heating is an energy intensive activity. As Figure 6.12 shows, 41% of the respondents do not own a heater, 41% use paraffin heaters, 9% use a paraffin (primus) stove, and 9% use electric heaters. In cold weather people go to bed early: 'Sometimes when we see that it is very cold we just took blankets and cover ourselves with blankets to become warm' (Questionnaire 147, Informal settlement). 'We warm ourselves by sleeping at an early hour to avoid bad weather or a very cold day'.

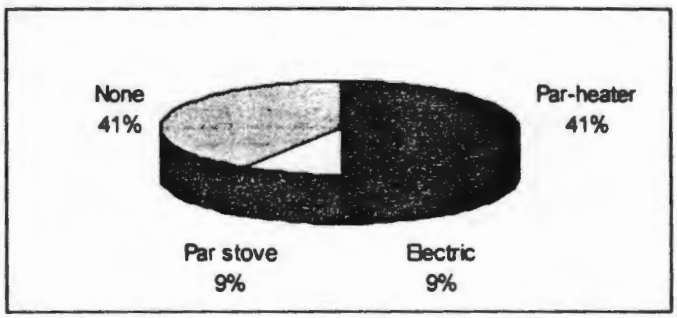

FIGURE 6.12 Space heating in informal houses

Of the fourteen informal households using paraffin heaters for space heating, 69% said that they used it because it was clean and safe, 92% because the fuel was cheap and 84% because the appliance was cheap and multipurposeful. Of the 9% using electric heaters all said they used it because it was clean, reliable and safe. None considered electricity or electric heaters to be cheap. The three households that use primus stoves for space heating did so because both the fuel and appliance were considered cheap and multipurposeful (see Figure 6.13).

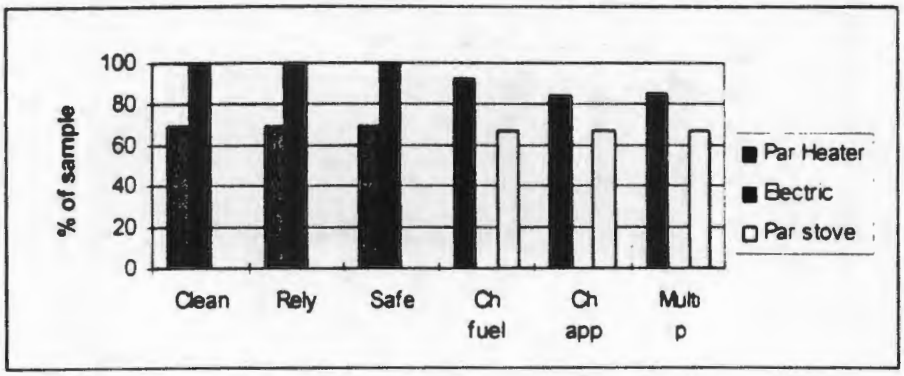

FIGURE 6.13 Reasons for using different methods for space heating in informal houses

6.6.1 Factors determining fuel and appliance for space heating

As Figure 6.14 shows, cleanliness, reliability of fuel and appliance and safety were the main concerns for space heating in formal houses. In contrast, cheap fuel, cheap appliance and multi-purpose use of appliances were the primary considerations among informal houses.

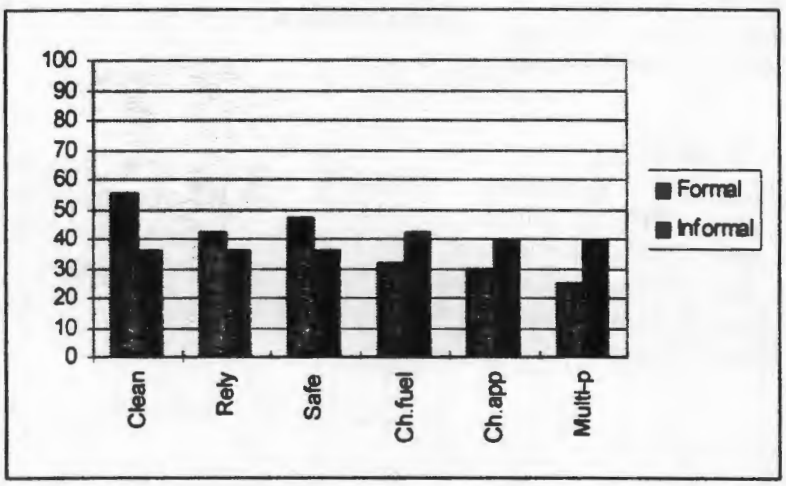

FIGURE 6.14 Fuel and appliance for space heating

6.7. Heating water for bathing

As Figure 6.15 indicates, most (60%) of these households use paraffin to heat water, 22% use electric kettles and 6% use electric stoves and 3% use an urn. The remaining 9% use gas to heat water for bathing.

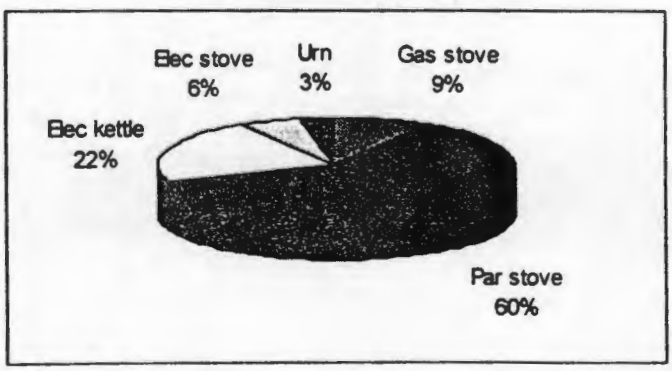

FIGURE 6.15 Heating water for bathing in informal houses

While 52% of the respondents indicated that they were satisfied with the present system, 48% said they were not. Answers to this question were ambivalent `Yes I am satisfied as I have no alternative/option' or `I would appreciate something else'.

6.8. Entertainment

> Electricity is easier to use than the batteries because batteries you must always go and charge it even if you have got no money.

As Figure 6.16 shows, of the sample, 19% did not have any form of home entertainment. Televisions were most popular and 59% of the respondents owned one, 19% owned radios and 3% had stereos. Most of them used electricity to run these appliances, except for two households which used car batteries.

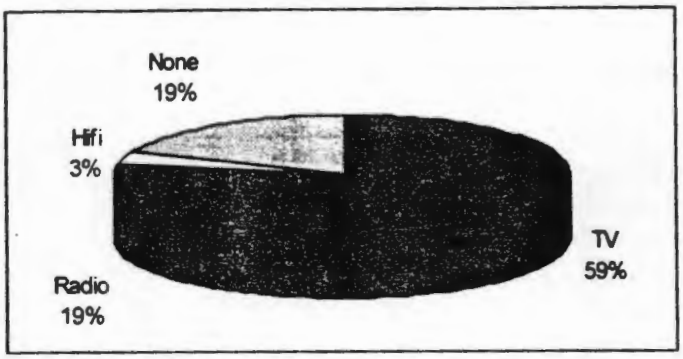

FIGURE 6.16 Entertainment in informal houses

6.9. Lighting

> All I can say is that life has been changed ever since we have electric. There is no need for buying candles and wiping lantern glasses all the time.

Lighting is the most immediate and affordable benefit associated with electricity. This section looks at the following issues:

i) fuels used for lighting in informal electrified homes on a daily basis;

ii) fuels used for lighting in informal electrified homes in emergencies;

iii) lighting times for summer and winter;

iv) reliability of power supply; and

v) causes of power failures.

Of the respondents in informal houses 93% used electricity for lighting, 3% used paraffin and 3% used gas. Reliability, convenience and safety are the most common reasons for using electricity for lighting. Reasons given for using an electric light bulb included that it was reliable, convenient, clean and safe. It is interesting to note that only 10% used electricity because they considered it to be cheap and only 7% used it because they found the appliance to be cheap. For those who continue to use paraffin for lighting, they did so because it was considered clean, reliable and convenient, in addition to the fact that they found the appliance and the fuel to be affordable. No-one considered paraffin to be safe (see Figure 6.17).

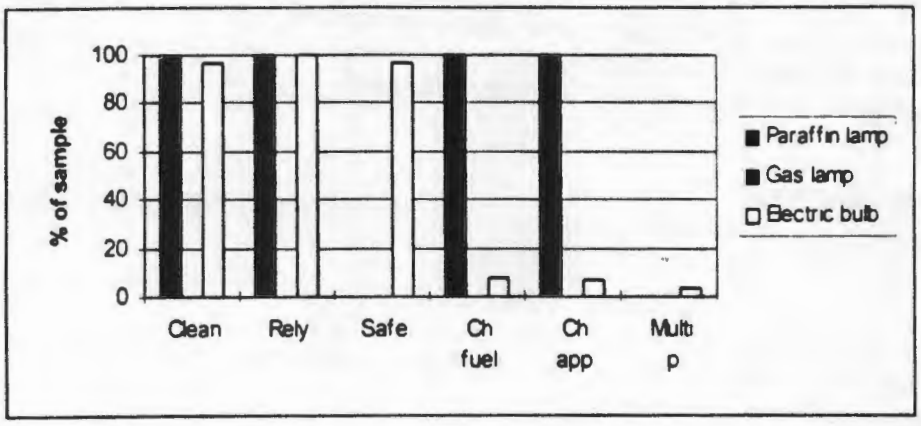

FIGURE 6.17 Reasons for using different methods for lighting in informal houses

Lighting is one of the more affordable benefits of electricity, but electricity is used more for its safety rather than its affordability. `Electrifying shacks is a very good idea because [it] lessens fires and accidents caused by paraffin, gas, and candles. Electricity is safe'. Another respondent remarked `Electric[ity] is doing a very good job and if you use electric you save a lot of money. You can use almost less than R40 per month, unlike when you use paraffin. Paraffin is also too dangerous'.

Paraffin and gas raise concerns and fear amongst residents because of the constant threat of accidents from fires. Being dependent on unsafe and unreliable fuels restrict and impede people's mobility: `As we are staying in a shack it is dangerous to leave anything on like a candle or paraffin lantern'; `You can stay without fear of a fire [if you have electricity]'; `You can go as far as where you want without the worry of fire'. Electrification has made a huge impact psychologically `since they install electricity we feel better and comfortable – and there is no worry of burning shacks'; `The electric is the best. Your house stays neat and clean and you feel safe and secure unlike when you are using paraffin'.

Cleanliness, reliability, convenience and safety were the most important concerns expressed by residents in the informal settlements with regard to lighting (see Figure 6.18). This has to be understood in the context of residents having being dependent on dirty, unreliable and dangerous fuels for lighting in the past. Electrification is a dramatic improvement with regard to peoples well-being and safety.

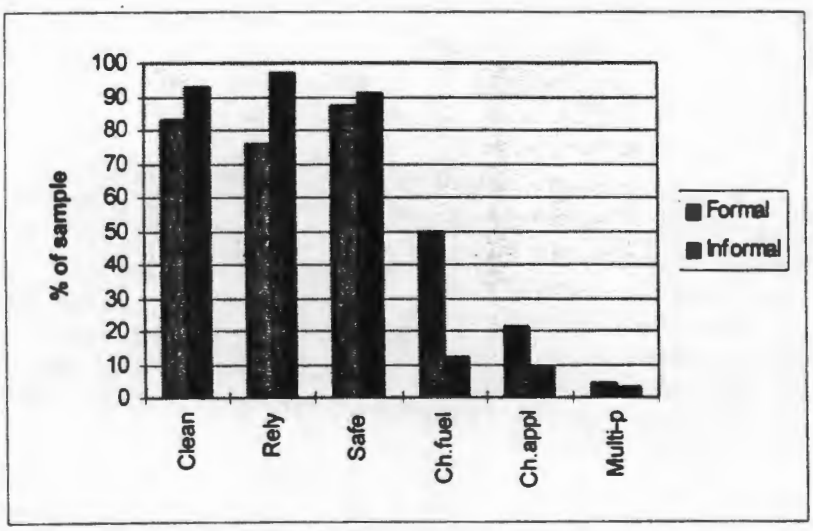

FIGURE 6.18 The factors determining fuel and appliance combination used for lighting in formal and informal houses

The majority (97%) of households use paraffin in emergencies while the remaining 3% use candles. The reasons people use paraffin and lanterns in emergencies in informal houses are that they are able to regulate the brightness, they are safer to use than candles and they can be

left on through the night. Moreover, people are already using paraffin to fulfill other end uses and therefore it is convenient – `I use paraffin lamp instead of candles because paraffin lamp extinguishes unlike candles'; `Electricity makes everything easy because there is no smoke nothing. Paraffin lantern although we are using it, it is not safe [and it] smokes a lot'; `As we are using electricity everyday we do not bother to buy candles every now and again we just buy them once we use them for that particular time and we keep them for next time'.

Generally, residents use lights for a shorter period in summer than in winter. In summer, informal houses average number of hours for in summer is 2.3 hours and the peak times are 8-10 pm and 7-9.30 pm. Informal houses use lighting for an average of 4 hours daily in winter.

6.9.1 Frequency of power failures

As Figure 6.19 indicates, only 39% of the respondents in the newly electrified homes in Site B did not experience power failures. Other respondents complained that it occurred often (22%), sometimes (34%), or weekly (3%). Respondents were asked what they thought the causes of power failures were. In response to this 46% of the sample were unsure of the causes, while this question was not applicable to 25% of the respondents, and 27% attributed the power failures to maintenance and repairs..

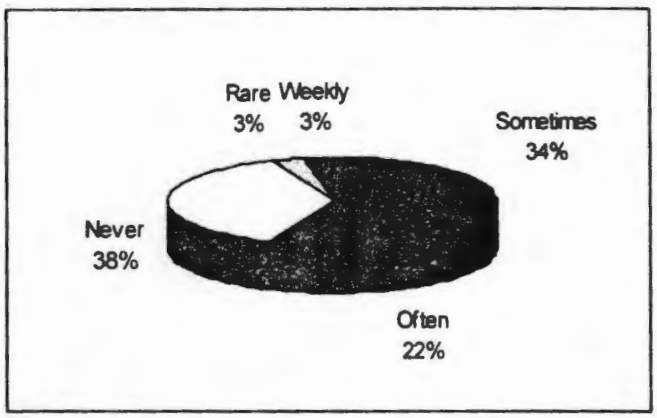

FIGURE 6.19 Rate of power failures in informal houses

6.10. Summary

Even though the sample is too small to be representative of Site B, it nevertheless gives an indication of fuel consumption patterns in newly electrified informal houses. Policy research of this nature needs to be informed by intensive qualitative research as the findings do not unravel all the complexities and issues around fuel use. Fuel use cannot be separated from income, housing structure, physical location, accessibility and affordability of fuels, and affordability of appliances, for example. Hence, most informal electrified houses continue to engage in multiple fuel use.

Most of these households can only afford to buy fuel in small amounts. The majority of respondents (64%) spend between R0 – R5 and R15 – R25 a month on electricity cards, while the majority of respondents (68%) spend R5 – R15 and R25 – R35 on their monthly paraffin purchases.

Therefore it is not surprising that electricity in informal houses is mainly used for lighting (97%) and media (79%). Lighting is the easiest and cheapest end use associated with electricity as it requires little investment in terms of appliances. Lighting has made a huge psychological impact on residents in terms of their safety. Despite the reduction in fire risk due to electric lighting the majority of households still use other fuels for other end-uses and hence are not immune to accidents and fires.

Prior to electrification many households owned electric radios and televisions (which ran on batteries) so the transition to electricity was relatively easy. The use of electricity for entertainment and media purposes is also convenient and cheaper in relation to other fuels. Only one-third of the sample use electricity for refrigeration and ironing as they cannot afford

these appliances. Furthermore, two-thirds of the sample continue to use other fuels for energy intensive activities such as cooking, heating water for bathing and space heating, for example. The high costs of electrical appliance serve as a barrier to greater electricity use. The lack of affordable appliances often have 'gendered' impacts as women, the primary users of energy, are forced to use less efficient ways, time-consuming of fulfilling different end uses. Women are responsible for cooking (100%) and ironing (61%) in informal houses. Cheap appliance and fuel and multi-purpose nature of fuel and appliances were often the determining factors for using paraffin for various end uses.

Appliance acquisition in formal and informal houses

This chapter attempts to uncover patterns of appliance ownership and the household dynamics around appliance purchase. Appliance ownership and decisions governing fuel and appliance use are an important but largely neglected area of domestic energy policy research. More research needs to be done since the cost of appliances, amongst other things, often acts as a barrier to using more convenient and cheaper fuels, including electricity. Energy end uses in low-income households cannot be understood without looking at patterns of appliance ownership as the cost and type of appliances will largely determine the type of fuel that is used. If the current electrification drive intends going beyond simply meeting RDP targets, it will need to make electrical appliances more affordable as expense is the primary reason for low electricity consumption in newly electrified areas. This chapter focuses on appliance acquisition in formal and informal houses, decision making regarding appliances, households priorities regarding appliances, the method of payment and barriers to appliance ownership.

7.1. Method of appliance acquisition in formal houses

The previous phases divided the formal household sample into two categories: Langa and Guguletu on the one hand, and Khayelitsha, on the other. This permitted longitudinal comparison between the sample in terms of method of appliance acquisition. Unlike previous phases which examined and compared the *general* acquisition of appliances under the different end-use categories and compared it to the previous phases, Phase 4 examines the financing of *individual* appliances under these end-use categories. The underlying argument being that the type of appliance will determine the manner in which it is acquired. The end-use categories in Phase 4 included cooking, ironing, space heating, water heating, clothes washing and lighting.

There are trends in appliance purchases amongst low-income households that reflect the fact that very few households can afford to buy new appliances. Often, only inexpensive appliances may be purchased for cash. Aside from acquiring appliances as gifts, financing larger, more expensive energy appliances involves developing alternate strategies. These include purchasing second hand items for cash or on lay-bye, buying new appliances on layby or hire purchase (HP), or through 'stokvels' or 'umgalelo' (group saving schemes). HP agreements and second hand items expose households to the danger of overpayment and second hand appliances are seldom guaranteed.

7.2. Cooking appliances

Figure 7.1 refers to the type of appliances ownership uncovered in Phase 4. In the established electrified houses of Langa and Guguletu, 4-plate electric stoves, electric toasters, paraffin stoves and electric pans were the most commonly owned appliances. Similarly, in the Khayelitsha sample, while the above mentioned appliances were also popular, gas stoves were more widespread than paraffin stoves. There were also more microwaves in Langa and Guguletu than in Khayelitsha. Electric pans were popular in both areas mainly because they were relatively affordable and they are multi-purpose (that is, they can be used for baking, roasting, frying, cooking and stewing). In the older, more established township households in Langa and Guguletu, people owned more 4-plate electric and paraffin stoves than in Khayelitsha. These trends are most likely linked to the fact that electrification in Langa and Guguletu occurred long before Khayelitsha and allowed for greater investment in electrical appliances. Owning a variety of cooking appliances may reflect strategies to address unreliable power supplies in both areas as well as the arrears situation in Langa and Guguletu.

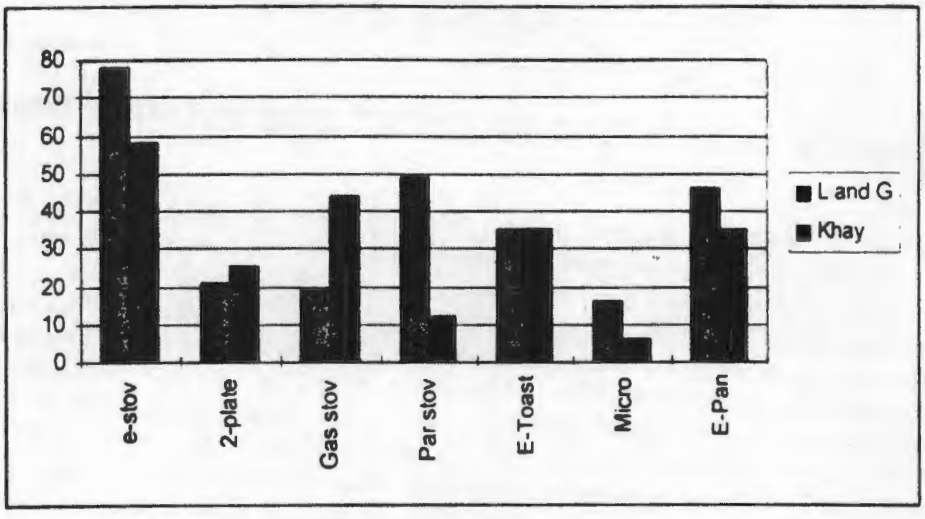

FIGURE 7.1 Ownership of cooking appliances in formal houses – Phase 4

7.2.1 The acquisition of cooking appliances in formal houses

Phase 3 suggested that the most common ways of acquiring cooking appliances was through hire purchase, cash and second hand (Thorne & Qangule 1994: 53). Phase 4 suggests the items bought generally determined the way it was paid for. As Figure 7.2 shows small appliances such as primus stoves, gas stoves, two-plate stoves and electric pans are generally paid for by cash. Primus stoves and two-plate stoves are affordable relative to other cooking appliances. The following cooking appliances were bought for cash: primus stoves (79%), two-plate stoves (69%), gas stoves (50%), and electric pans (48%). The remaining electric pans were either gifts (24%) or were bought on HP (21%).

Four-plate stoves and microwaves are the least affordable appliances and HP methods are a common way of financing large, expensive electrical appliances. The majority of respondents (56%) bought their four-plate stoves on HP and 25% of the respondents bought their stoves second hand for cash. HP agreements were also used to finance gas stoves (22%), microwaves (20%) and electric pans (21%). Gifts were also a common way of acquiring appliances. In fact, 60% of the respondents who owned microwaves received them as gifts. Other gift items included electric pans (24%) and to a lesser extent primus and gas stoves.

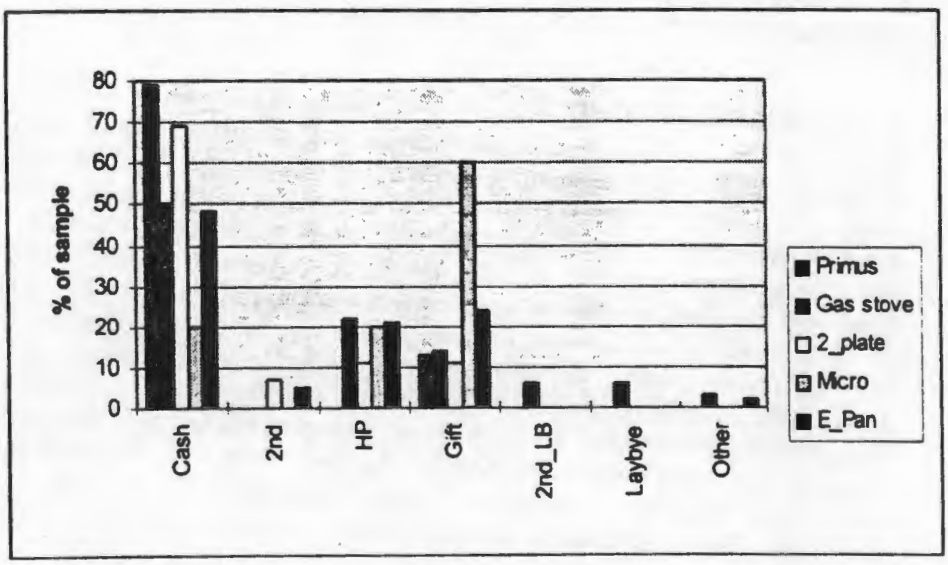

FIGURE 7.2 Method of acquiring cooking appliances in formal houses (Langa, Guguletu and Khayelitsha)

7.2.2 The acquisition of washing machines in formal houses

A total of 25 respondents in formal houses owned electric washing machines. In Phase 3, the majority of the respondents in Khayelitsha (57%) purchased their washing machines new on HP, while 43% bought them new for cash. In Langa and Guguletu, washing machines were bought new on HP or second hand for cash (Thorne & Qangule 1994: 68). In Phase 4, 40% acquired washing machines new on HP, 20% bought their washing machines new for cash, 8% bought second hand and 8% received their washing machines as gifts. Over 24% did not answer and they fell in the 'other' category (see Figure 7.3).

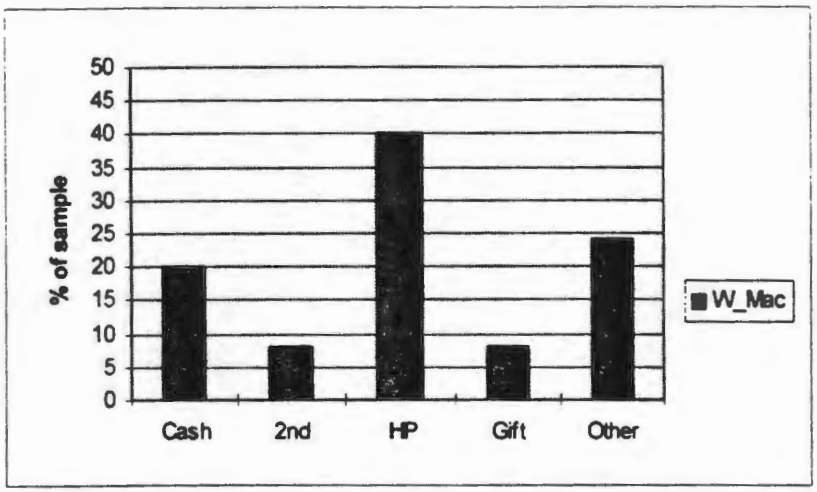

FIGURE 7.3 Method of acquiring washing machines in formal houses (Langa, Guguletu and Khayelitsha)

7.2.3 Acquisition of irons in formal houses

In Phase 3, most respondents in Langa, Guguletu and Khayelitsha owned electric irons of which most were bought new for cash (Thorne & Qangule 1994: 70). In Phase 4 irons were disaggregated and it was found that steam irons were the most commonly owned. As Figure 7.4 indicates, over 72% of the respondents bought steam irons for cash, while 4% purchased these irons second hand, 7% bought them on HP and 4% received them as gifts. The remaining 2% of the sample financed their steam irons through *stokvels* or *umgalelos*. Of the 11 respondents that used electric irons, the majority (55%) had bought them second hand cash, while 35% received them as gifts. Once again, it is interesting to note that gifts are a common means of appliance acquisition among low-income households. Only one formal household owned a flat iron and this had been bought second hand for cash. The 'other' category refers to those respondents who could not remember how they financed their appliances, or borrowed appliances from their neighbors and/ family, or did not answer.

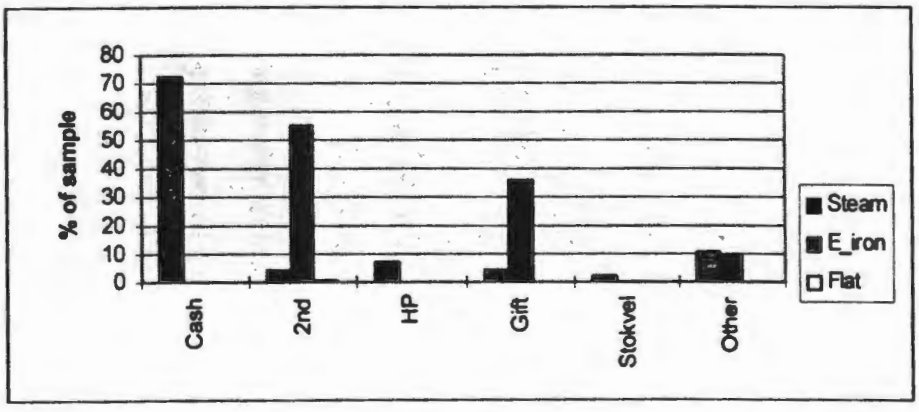

FIGURE 7.4 Method of Acquiring Irons in Formal Houses (Langa, Guguletu and Khayelitsha)

7.2.4 Space heating acquisitions in formal houses

Cash payments were the most common way of acquiring space heating appliances in Phase 3 (Thorne & Qangule 1994: 55). However, Phase 4 differentiated between different types of appliance acquisition and many interesting findings were revealed. Of the 27% of respondents who owned paraffin heaters, 32% were financed by cash, 16% were bought second hand, 26% were bought on hire purchase, 6% were received as gifts and 6% bought on lay-byes. Paraffin heaters fulfill multiple functions in winter as it is used to cook food and heat the house at the same time. These heaters are also used to heat water for bathing and to dry clothing. Of the sample, 14% fell in the 'other' category: either they did not have any means of space heating, failed to answer the question or could not remember how they acquired the heaters.

Approximately 44% of respondents in formal houses owned electric heaters and more respondents paid cash for their electric heaters as compared to paraffin heaters. Of those respondents who owned electric heaters, 64% of them paid cash, 2% bought them second hand and 5% bought them on hire purchase. Of the sample, 14% obtained their electric heaters as gifts. The remaining 14% fell into the 'other' category: either they did not have any means of space heating, failed to answer the question or could not remember how they acquired their electric heaters. A small proportion (4%) of respondents owned gas heaters, of which 20% paid cash for it, 20% obtained it second hand, 20% paid it off on lay-bye and 40% fell in the 'other' category (see Figure 7.5).

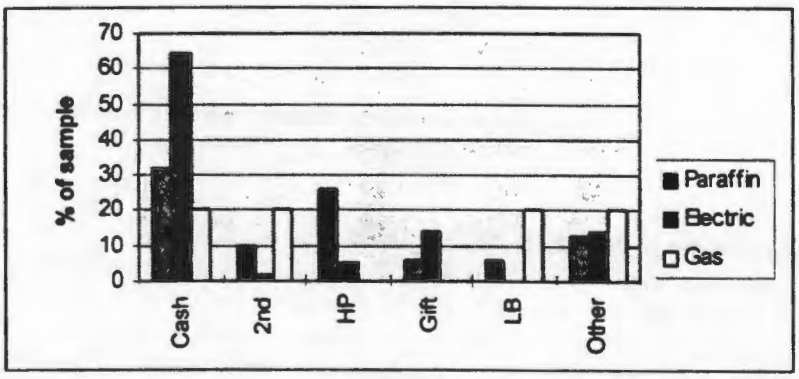

FIGURE 7.5 Method of financing space heating appliances in formal houses
(Langa, Guguletu and Khayelitsha)

7.2.5 Method of financing refrigerators

The majority (94%) of the formal houses own refrigerators of which 90% were electrical. In Phase 3, the means of acquiring these refrigerators included bought new for cash, bought on hp, second hand for cash, or acquired as a gift (Thorne & Qangule 1994: 73). As shown in Figure 7.6, in Phase 4, 59% of the refrigerators were bought on HP, and 16% were bought second hand for cash. Only 4% of the respondents were able to purchase fridges new for cash, and 2% bought second hand refrigerators on lay-bye. One respondent bought a refrigerator through 'umgalelo'. The remaining 13% constituted the 'other' category which included those that did not answer, could not remember, or were sharing refrigerators with neighbors.

Four of the respondents owned gas refrigerators, of which one was bought on HP. Three respondents could not remember how they acquired it. Freezers were included under refrigeration. In total, fifteen respondents owned freezers of whom one paid cash, 2 bought it second hand, and 6 bought them second hand on lay-bye. The remaining 6 respondents fell in the 'other' category; they did not answer or they could not remember how they acquired their freezers.

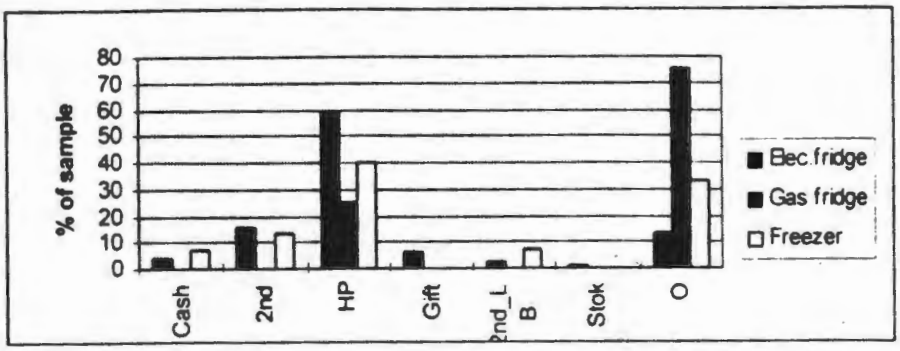

FIGURE 7.6 Method of acquiring refrigerators in formal houses (Langa, Guguletu and Khayelitsha)

7.2.6 Method of acquiring water heating appliances

As Figure 7.7 indicates, only 45% of the respondents in formal houses owned geysers, of which 43% were electric and 2% were gas operated. Electric kettles and electric urns were included under water heating as they are often used to heat water for bathing. Over three-quarters of the sample owned kettles, of which 62% of electric kettles were paid by cash, 2% were bought second hand, 8% were financed on HP and 11% were gifts. The remaining 21% fell in the category 'other' which included respondents who borrowed kettles, respondents who could not remember the details or did not answer. A total of 15 of the respondents owned gas geysers, of which 2 respondents bought it on HP while the remaining 11 were listed in the 'other' category: they could not remember or did not answer. Only 45% of the sample reported owning electric geysers, but many failed to give details on how they purchased the geysers and so fell into the 'other' category. Geysers could be made accessible to low-income households by including it in the costs of the house and allowing the owner to pay it off in instalments.

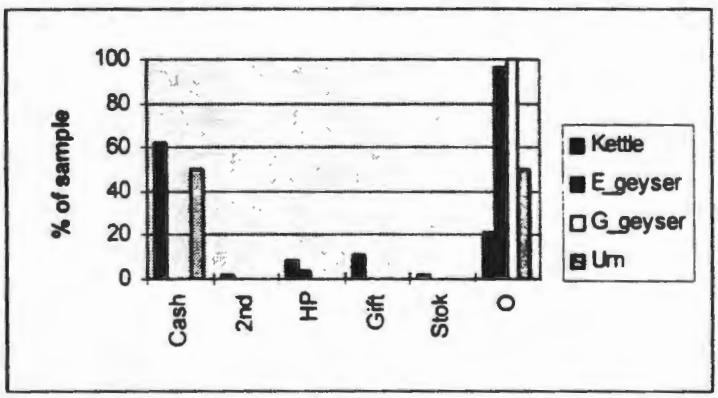

FIGURE 7.7 Water heating appliances in formal areas (Langa, Guguletu and Khayelitsha)

7.2.7 Method of financing entertainment appliances

As in Phase 3, HP agreement were the most common way of financing entertainment appliances. In fact, as highlighted in Figure 7.8, 73% of the respondents used HP to finance televisions and 66% used HP to buy hi-fis. Only 10% of the respondents were able to purchase their televisions for cash, and 5% bought theirs second hand for cash. Of the sample, 4% of the respondents received their televisions as gifts and 8% through 'other' means including borrowing them from neighbors or relatives, watching TV at their relatives' or neighbors' homes, or they could not remember how they acquired them. Only 6 of the respondents owned M-Net decoders of which half of them are paying it off through HP; while one person bought it for cash, and one bought it second hand. Of the respondents who owned video recorders, 37% bought it on HP, 21% received it as a gift, 5% bought them second hand, 11% paid cash for them and 26% were in the 'other' category which included those who did not know or did not remember how they acquired it. Regarding radio/tape, 38% paid cash, 8%

paid for it on HP, 18% received it as a gift, 3% received it through a *stokvel*, and 3% bought it new on lay-bye. One third fell in the 'other' category as they could not remember the details of the purchase.

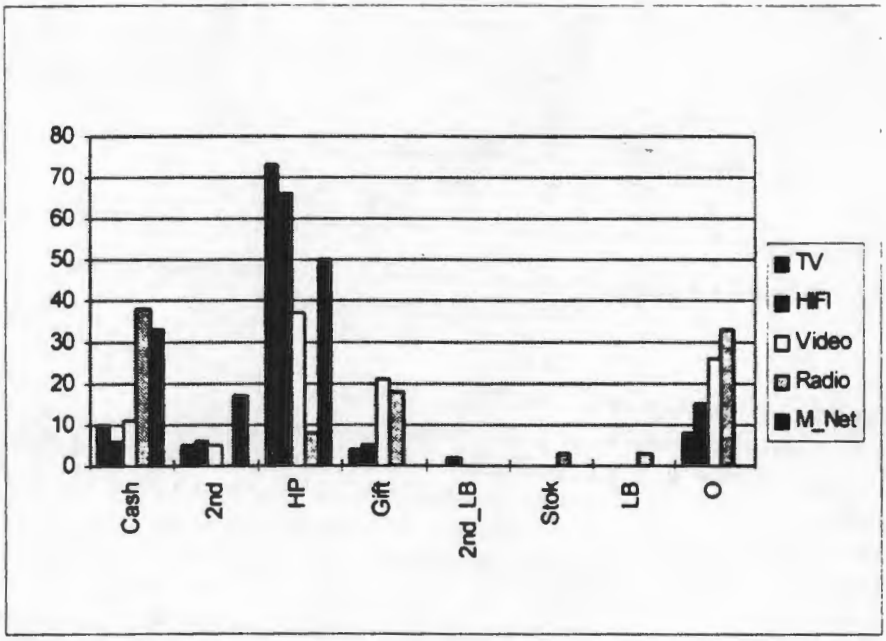

FIGURE 7.8 Method of acquiring entertainment appliances (Langa, Guguletu and Khayelitsha)

7.2.8 Lighting in formal houses

Of the formal houses, 96% use electricity for daily lighting and they use ordinary light bulbs; 2% use gas and 2% use paraffin. As in Phase 3, most respondents paid cash for their appliances.

7.3. Appliance acquisition in informal houses

This section examines the way appliances are acquired in informal houses. It focuses mainly on appliances used for cooking, ironing, refrigeration, entertainment, space heating, water heating (kettles). As in the formal houses, most of the respondents paid cash for their light bulbs.

7.3.1 Method of acquiring cooking appliances

As indicated in Figure 7.9, all the respondents in informal houses who owned 4-plate electric stoves bought them new on HP. Of the respondents who owned gas stoves, 63% bought them new for cash, 12% bought them second hand for cash, and 25% bought it new on HP. The majority (85%) of the respondents bought their primus stoves new for cash, while 7% paid it off on HP and the remaining 7% fell in the 'other' category where the respondent could not remember the details or did not know how they acquired the appliances. Of those who owned electric pans, 67% of the respondents bought it new for cash, and 33% bought them on HP. Kettles in these homes fulfil a dual purpose: it is used to make beverages and to heat water for bathing. Of those respondents who owned kettles, 64% bought those new for cash, 9% bought them second hand and 27% bought them new on HP.

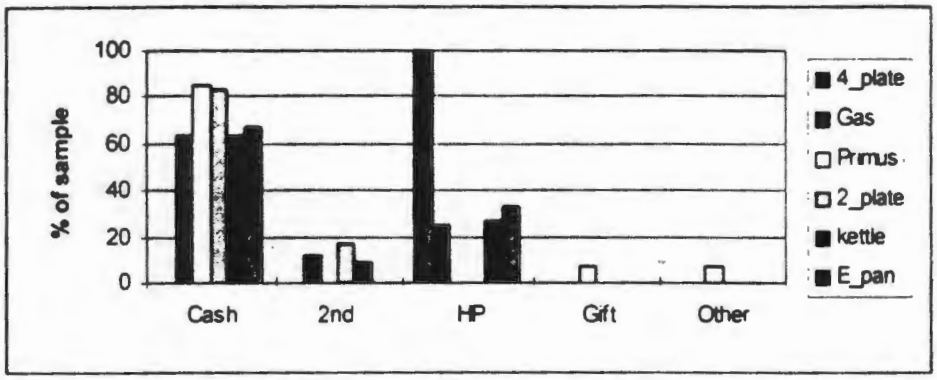

FIGURE 7.9 Method of acquiring cooking appliances in informal houses

7.3.2 Method of acquiring irons

One-third of the respondents in informal houses own electric steam irons. Of the sample, 50% paid cash, 20% of the respondents bought it in HP, 20% received them as gifts and 10% formed part of the 'other' category: the respondents could not remember the details or did not answer. Over half of the respondents (55%) used flat irons of which 78% paid cash (see Figure 7.10).

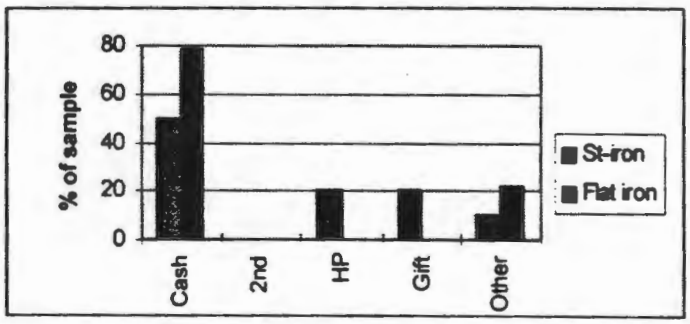

FIGURE 7.10 Method of acquiring irons

As Figure 7.11 reveals, all the respondents who owned electric heaters paid cash for them. Of those who owned paraffin heaters, 43% paid cash, 36% bought them second hand, 14% bought them on HP, and 7% received them as a gift.

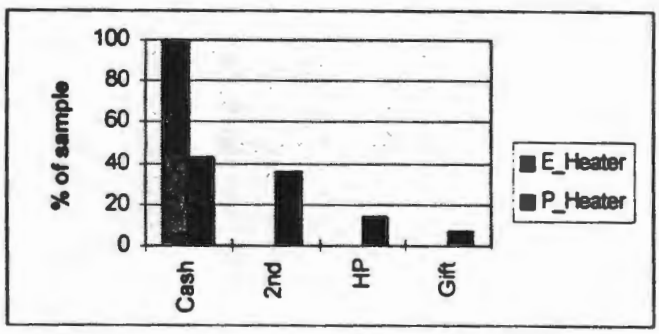

FIGURE 7.11 Method of acquiring space heating appliances in informal houses

7.3.3 Method of acquiring heaters

Of those respondents who owned televisions, 79% bought them on HP. All those who bought hi-fi systems financed the purchase on HP. With regard to radios, 63% bought theirs new for cash, and 19% received their radios as gifts. The remaining 18% fell in the 'other' category: they could not remember the details of their purchase (see Figure 7.12).

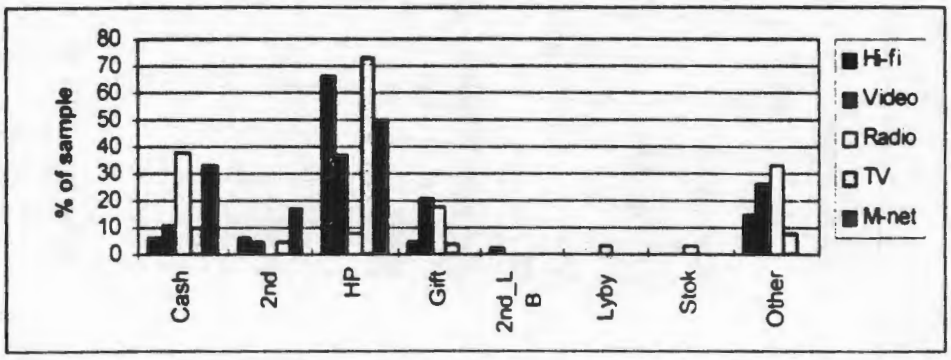

FIGURE 7.12 Method of acquiring entertainment appliances in informal houses

7.4. Decision making with regard to energy appliances

This section explores the gender dynamics surrounding fuel and appliance use. Phase 4 attempted to use a quantitative approach to uncover the decision-making on appliances and fuel use at the household level. There were several limitations in using this approach and these resulted in a superficial understanding of decision making around fuel and appliance use. The approach entailed including a list of energy appliances with a column to identify the person responsible for deciding on the purchase of the appliance. Four options were included: 'man', 'woman', 'joint' and 'other'. The fact that were some emerging trends suggest that decision making is 'gendered' but there is a need for more detailed research.

The trends were difficult to decifer since they were not cross tabulated with household type. Hence, decisions that were supposedly made by a woman may have been made either in a woman headed household or in a typical nuclear family context. Many decisions on appliance purchase were reportedly done 'jointly'. The option 'joint' could refer to decisions taken in consultation in a context of limited resources where household members are forced to prioritise, but nevertheless the possibility remains that these priorities are 'gendered' as *someone* decides finally that it is a priority.

In most instances, the decisions around purchasing kitchen appliances were taken jointly. One might assume that since women are the primary users of kitchen appliances, they have the final decision. The fact that these decisions then are seldom made by women reveals their limited access to resources and decision making in a nuclear family setting. In the case of appliances that are relatively affordable, women are able to purchase them directly. For example, as Figure 7.13 and Figure 7.14 indicate, the majority of the decisions in formal houses regarding primus stoves and electric irons were made by women, whereas the decisions to purchase steam irons in the informal houses were taken jointly. It would be interesting to explore whether women's priorities were the same as the men's regarding the type of iron to be purchased. In short, it would be interesting to see whether women and men have similar or different priorities when it comes to deciding on appliance expenditure.

The basic point is that there are indications that decision making in appliance purchase and use is a 'gendered' phenomenon but further research is required. Future research needs to be focused and combine both quantitative and qualitative methods. Further, a gender perspective needs to be utilised; that is, instead of focusing solely on women's needs, the research should target *both* men and women to explore their individual needs, interests, priorities on appliances and fuels.

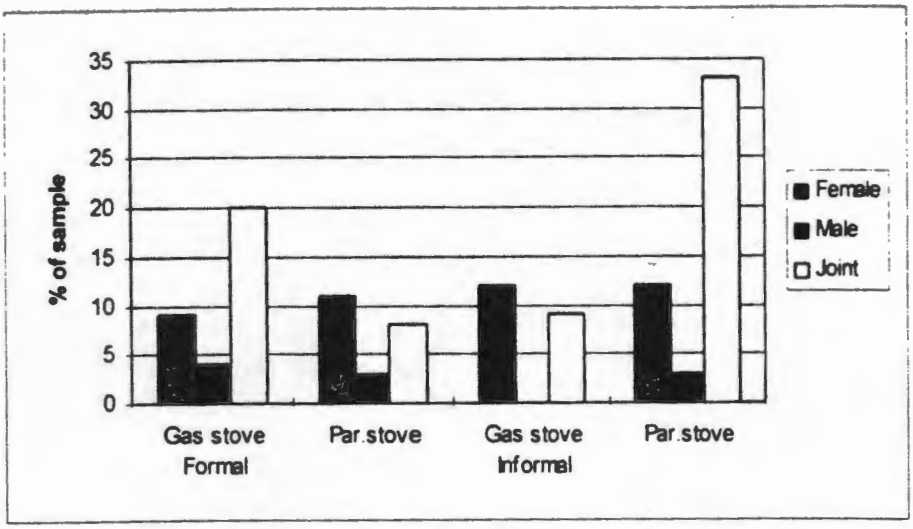

FIGURE 7.13 Decision making with regard to non-electric cooking appliances

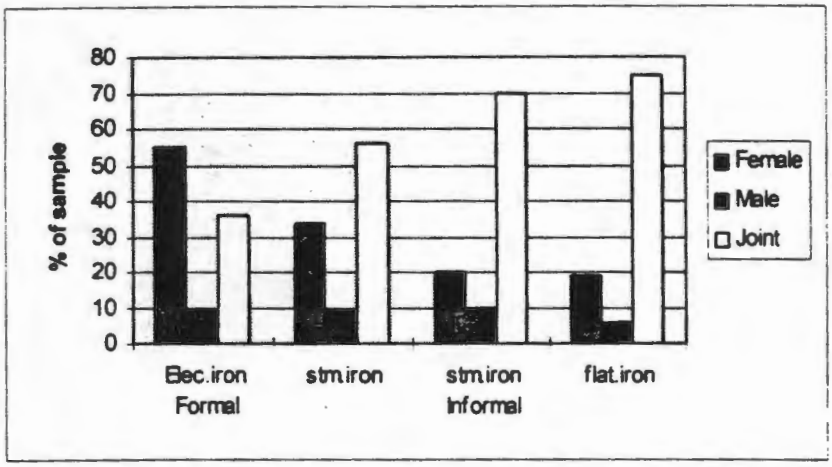

FIGURE 7.14 Decision making with regard to irons

Apparently, where possible, women are willing to pay extra to have the comfort and convenience. As one female respondent stated `Rather I pay more for electricity than having to clean walls and suffer coughs with paraffin'. There were some instances where the respondent stated that `I decide on kitchen appliances, my husband decides on entertainment'. Financial stability and security also influences fuel and appliance use. For example, a domestic worker whose income is unpredictable, lives with her brother, a municipal worker. She is restricted from buying appliances because `he is responsible for the running of the house'. Further, she is responsible for the telephone and transport expenses and he pays the electricity bill. In response to the question on future appliance priorities she states `My brother decides what to use because he is paying'. Is it surprising that he would limit the number of electrical appliances that they own?

The study also revealed the possible influences that children might have in decisions around appliances. One of the respondents, a young female student, viewed a washing machine as a priority item as `it saves time and I can do something else when washing'. When asked about the barriers in terms of appliance acquisition she said `As soon as I work full time. My father is very stubborn; he always tells us to wait. He decides what to buy because he has the money'.

7.5. Prioritisation of energy appliances in formal and informal houses

This section examines the prioritisation of new energy appliances. The open ended question, `What appliance is top of your list and why?' was posed. Answers were difficult to analyse

since responses were diverse. Nevertheless, the question may aid policy interventions in so far as it establishes people's priorities and locates household demand for appliances.

Appliance preference differed between formal and informal households and also between male and female respondents. It is interesting to note that most appliances that people focused on were electrical except for paraffin heaters. The most common first need in formal electrified houses was a washing machine (33%), followed by a 4-plate stove (17%), entertainment facilities such as televisions, video-recorders and radios (15%), and microwaves (8%). Other needs included freezers, refrigerators, and toasters. In informal houses, 52% of the respondents saw a 4-plate electric stove as the first priority, followed by a fridge (15%), television (6%). When women opted for TVs and videos as a priority they stated that they needed entertainment for their children (not reflecting their first own immediate needs but that of their family). The reasons given for the first choice was time-saving (19%), convenience (30%), to cook different dishes which saves labour and energy (see Figure 7.15).

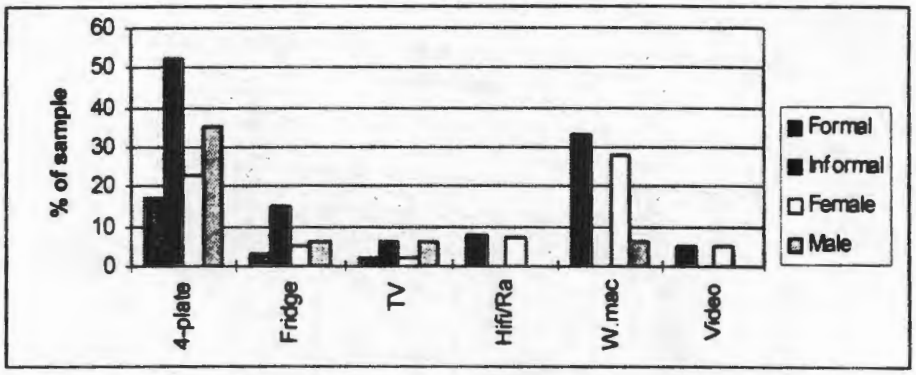

FIGURE 7.15 Appliances regarded as a priority

The most popular second priority appliance amongst formal houses included electric frying pans (9%), washing machines (8%), video-recorders (11%), vacuum cleaners (10%), microwaves (9%), and also included refrigerators, other entertainment appliances, irons and freezers. The second priority energy appliance in informal houses included refrigerators (21%), televisions (15%), and hi-fis (9%). Refrigerators are regarded as a top priority by men in informal houses as it is viewed as potentially income-generating (see Figure 7.16). Approximately 10% of the respondents said that would pay cash for these appliances, while most respondents said they would finance appliances through HP.

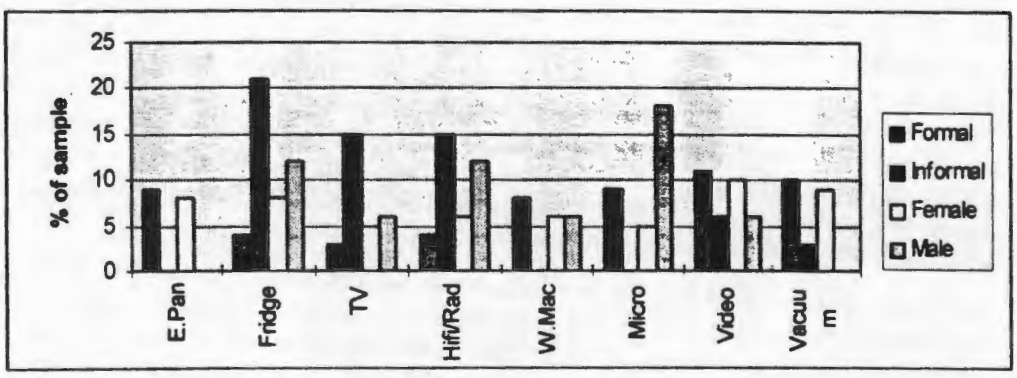

FIGURE 7.16 Appliances rated as the second priority

7.6. Summary

Energy end uses in low-income households cannot be understood without looking at patterns of appliance ownership as the cost and type of appliances will largely determine the type of fuel that is used. There are trends in appliance purchases amongst low-income households that reflect the fact that very few households can afford to buy new appliances. Often, only

inexpensive appliances may be purchased for cash. Aside from acquiring appliances as gifts, financing larger, more expensive energy appliances involves developing alternate strategies including purchasing second hand items for cash or on lay-bye, buying new appliances on lay by or Hire Purchase (HP), or through *stokvels* or *umgalelo* (group saving schemes). However, HP agreements and second hand items expose households to the danger of overpayment and second hand appliances are seldom guaranteed.

In the older, more established township households in Langa and Guguletu, people owned more 4-plate electric and paraffin stoves than in Khayelitsha. These trends are most likely linked to the fact that electrification in Langa and Guguletu occurred long before Khayelitsha and allowed for greater investment in electrical appliances. Owning a variety of cooking appliances may reflect strategies to address unreliable power supplies in both areas as well as the arrears situation in Langa and Guguletu.

In Khayelitsha gas stoves were more widespread than paraffin stoves. Small appliances such as primus stoves, gas stoves, two-plate stoves and electric pans are generally paid for by cash. Primus stoves and two-plates stoves are affordable relative to other cooking appliances. The cooking appliances were bought for cash included primus stoves (79%), two-plate stoves (69%), gas stoves (50%), and electric pans (48%). The vast majority of respondents (56%) bought their four-plate stoves on HP and 25% of the respondents bought their stoves second hand for cash. 40% of the respondents acquired washing machines new on HP and 20% bought them new for cash. Electric irons were disaggregated and it was found that steam irons were the most commonly owned. Over 72% of the respondents bought steam irons for cash. Of those who owned conventional electric irons, the majority (55%) had bought them second hand for cash, while 35% received them as gifts.

Paraffin heaters were usually bought for cash (32%), cash (16%) or on HP (26%). 59% of the refrigerators were bought on HP, and 16% were bought second hand for cash. Only 4% of the respondents were able to purchase fridges new for cash. Most repondents financed their entertainment applainces on HP: 73% of the respondents used HP to finance televisions and 66% used HP to buy hi-fis. Only 10% of the respondents were able to purchase their televisions for cash.

All the respondents in informal houses who owned 4-plate electric stoves bought them new on HP. Of the respondents who owned gas stoves, 63% bought them new for cash, 12% bought them second hand for cash, and 25% bought it new on HP. The majority (85%) of the respondents bought their primus stoves new for cash. Of those who owned electric pans, 67% of the respondents bought it new for cash, and 33% bought them on HP. Of those respondents who owned kettles, 64% bought those new for cash and 27% bought them new on HP.

One-third of the respondents in informal houses own electric steam irons. Of the sample, 50% paid cash, 20% of the respondents bought it in HP and 20% received them as gifts. Of the repondents who used flat irons 78% paid cash. All the respondents who owned electric heaters paid cash for them. Of those who owned paraffin heaters, 43% paid cash, 36% bought them second hand, 14% bought them on HP, and 7% received them as a gift. Of those respondents who owned televisions, 79% bought them on HP. All those who bought hi-fi systems financed the purchase on HP. With regard to radios, 63% bought theirs new for cash.

In most instances, the decisions around purchasing kitchen appliances were taken jointly. The fact that these decisions then are seldom made by women reveals their limited access to resources and decision making in a nuclear family setting. In the case of appliances that are relatively affordable, women are able to purchase them directly. The majority of the decisions in formal houses regarding primus stoves and electric irons were made by women, whereas the decisions to purchase steam irons in the informal houses were taken jointly. The basic point is that there are indications that decision making in appliance purchase and use is 'gendered' phenomenon but further research is required. Future research needs to be focused and combine both quantitative and qualitative methods. Further, a gender perspective needs to be utilised; that is, instead of focusing solely on women's needs, the research should target ***both*** men and women to explore their individual needs, interests, priorities on appliances and fuels.

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The most popular second priority appliance amongst formal houses included video-recorders (11%), electric frying pans (9%), washing machines (8%), vacuum cleaners (10%), microwaves (9%). The second priority energy appliance in informal houses included refrigerators (21%), televisions (15%), and hi-fis (9%). Approximately 10% of the respondents said that would pay cash for these appliances, while most respondents said they would finance appliances on HP.

General information

This chapter outlines a range of general issues that emerged from the questionnaire.

8.1 Inconsistent tariffs

The electricity tariff rate for the three townships varies widely. As highlighted in Chapter Three, the residents in Langa and Guguletu who are in arrears were unaware of the 14% surcharge on prepayment meter system. Further, of the different types of prepayment meters being installed, respondents charge that some meters consume more electricity than others. In Khayelitsha, Eskom loses an average of R800 000 a month because of electricity theft and some respondents felt that they were being charged more for electricity as a result. One respondent stated 'We have to foot the bill for those who are stealing'.

8.2 Prepayment meter systems and credit meter systems: preference, accessibility and use

The type of electricity meter system installed influences the way in which electricity is used and encourages multiple fuel use in two ways. First, users are able to gauge the costs of energy intensive activities more closely and therefore might choose to switch to other cheaper fuels. Second, when units run out or when the user runs short of money, people switch to other fuels. Of the formal household sample (Langa and Guguletu), 27% had credit meter electric system and 72% had prepayment meter systems. All the houses in Site B have prepayment meter systems.

Respondents in Langa and Guguletu had mixed feelings towards the replacement of credit meters with prepayment meter systems. Some respondents welcomed this but others were sceptical of the CCC's motives. They asked why these boxes were only being installed in the townships and not in the white suburbs and argued that they had already paid for the installation of credit meters and now had to pay for the prepayment meter boxes as well.

Of the respondents, 82% (both the formal and informal houses) were in favour of the card system. The views on the prepayment meter system were gauged through open-ended questions and gave rise to various responses. Respondents in formal houses complained that, in the past, the electricity department often simply estimated their monthly bills without reading their meters. Thus they believed the card system to be transparent as they are now able to pay for what they use. Respondents also felt that the card system made it easy to budget for electricity and that it was easy to use. In addition, they could read the meter, see when the units ran out, without the need for accounts. Similarly, respondents in informal houses preferred the card system because they maintained control; they could see when the units finished and found it easy to use. Of the respondents in formal houses, 12% were dissatisfied with the prepayment meter system because it needed cash up front and the units were used up quickly. They appeared satisfied with the credit meter system but found the prepayment meter system inconvenient.

The accessibility of prepayment meter card sale depots and sale hours for cards are important influences on electricity consumption. Of the total sample, only 54% of the respondents in formal houses and 46% of the respondents in informal houses found depots to be accessible. This highlights the need to ensure that card sales business hours are convenient, and that outlets are available not just in the townships. The fact that respondents in Langa and Guguletu spend an average of R3 on travelling to depots discourages them from using electricity and also means that they can afford R3 less for electricity. In the formal house sample, 60% found the sale hours convenient and 88% of the respondents in informal houses were satisfied with the current sale hours.

Formal houses bought electricity for amounts ranging from R5 to R250. Of the formal houses, 9% of the respondents spent R20, 14% spent R50, 10% spent R100, 7% spent R120 at a time. By contrast, while the amount spent by informal households ranged from R5 to R120, most of the

respondents (33%) spent R10 on the card electricity, 24% bought R20 worth of electricity, and 12% bought R50 worth. Only 7% of households in formal and informal houses could afford spare cards.

Only 43% of those formal households that have pre-payment meters use their electricity for all end-uses. 14% reported not using the card system for all activities. Of the informal house sample, only 12% of the respondents reported using electricity for all end uses.

Respondents were asked if they ever lodged complaints to the electricity department and whether they were satisfied with the response. Amongst the formal electrified houses, 45% of the respondents stated that they never complained, 19% were dissatisfied with the response when they did, and 26% were satisfied. In the informal settlements 52% of the respondents never complained, 15% reported that they were unhappy with the response while 27% were satisfied. Clearly, suppliers need to improve their services.

The question regarding the layout of electricity bills was only applicable to 27% of the respondents in the formal houses. Of these respondents, 20% said that they were satisfied with the current layout and 7% were not. Regarding the language of the account, 14% of the respondents wanted the account in English, 5% wanted it in Xhosa, and 8% felt that the account should be presented in two languages.

Of the formal household sample, 51% found electricity to be affordable, and 26% said that it was unaffordable. Some of the respondents needed to qualify their response: 5% said that, relative to other fuels, electricity was affordable, and 7% said that while electricity was unaffordable the card system is affordable. Of the informal household sample, 94% of respondents said electricity was affordable.

Only 2% reported problems or had accidents with fuels: 75.5% of the sample said they had no accidents and 23% did not answer. Respondents were also asked whether they knew about the Masizakhe Energy Centre (an energy information centre, an initiative of the DMEA, located at the LWCC in Khayelitsha) and whether additional energy centres should be built. Amongst the formal household sample, only 9% of the respondents had heard of the Centre and 24% of the respondents thought that there should be more of these energy centres. Almost all the respondents in the informal household sample (97%) were unaware of the Centre and only 12% thought that there should be more of these types of energy centres. All the respondents in both settlement types said they would find information on electricity use very useful.

8.3 Preferred lighting for streets

In the past, street lighting in urban townships were given low priority and, like other community services, was of a poor standard. There is a need to view the electrification programme holistically and street lighting should become an integral component of the programme. Street lighting helps to ensure the personal safety of individuals and property. It also improves the mobility and safety of the more vulnerable groups (especially women, the aged and children). The majority of the respondents in both settlement types preferred high mast lighting to street lighting and this reveals high degree of insecurity felt by residents. From the respondents interviewed in the formal houses, 77% preferred the high mast lighting, and 17% preferred street lights. In the informal houses, 54% opted for high mast lighting, and 33% chose street lights.

The overwhelming majority of respondents (72%) chose the high mast form because it is bright. Other reasons given by the formal houses included personal safety, prevention of crime, not easily broken, help in identifying people, reliability, saving on personal electricity, and coverage of a bigger area. Street lights were preferred by others because they are reliable, easy to fix, close to the house, more effective, and the ability to identify criminals and strangers.

8.4 Paraffin usage: use, accessibility and safety

Currently, almost a third of the respondents (28%) in formal electrified houses use paraffin. Respondents were asked why they used paraffin even though they had access to electricity. Amongst people using paraffin, 6% say that they use it in emergencies (cuts in electricity

supply or when units run out) and 5% to save electricity. The 'other' category includes those who use paraffin for baking (2%); space heating (4%), because paraffin was a cheaper fuel (4%), do not possess all electrical appliances (4%), only use it occasionally (1%), do not own any electrical appliances (1%) and to save money (1%) (see Figure 8.1).

Until electrical appliances and electricity is made affordable and people's fear around using gas is addressed, paraffin will continue to be used in electrified informal houses. Although paraffin and its appliances are relatively affordable, the costs of using paraffin is high. The dangers of paraffin usage is manifest in the high incidence of fires and domestic accidents (women and children are particularly at risk) in informal settlements. According to recent statistics, burns are one of the top four causes of injury and mortality in the under-14 age group. Furthermore, domestic accidents related to cooking and heating (mostly wood and paraffin) caused 21% of child deaths (Lerer: unknown).

As Figure 8.2 indicates, paraffin is more widely used in newly electrified informal homes, but *not* because it is a preferred fuel. In fact, 55% of the respondents use paraffin because they do not own any electrical appliances. Other respondents use paraffin in emergencies (9%), when they run out of electricity (9%), and to save electricity (6%). The 'other' category includes those not having enough – or all electrical appliances as well as those who argue that paraffin lasts longer than electricity.

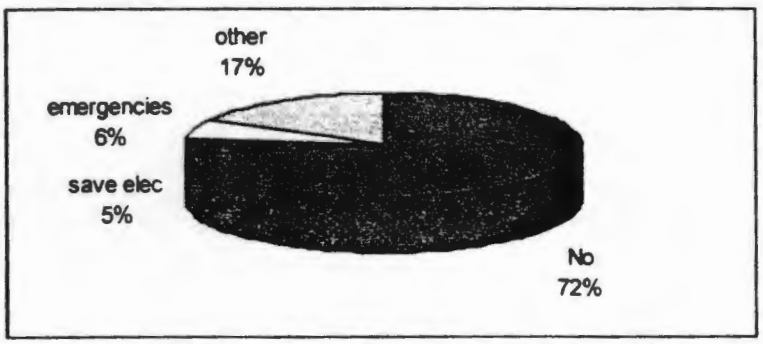

FIGURE 8.1 Paraffin usage in formal electrified houses

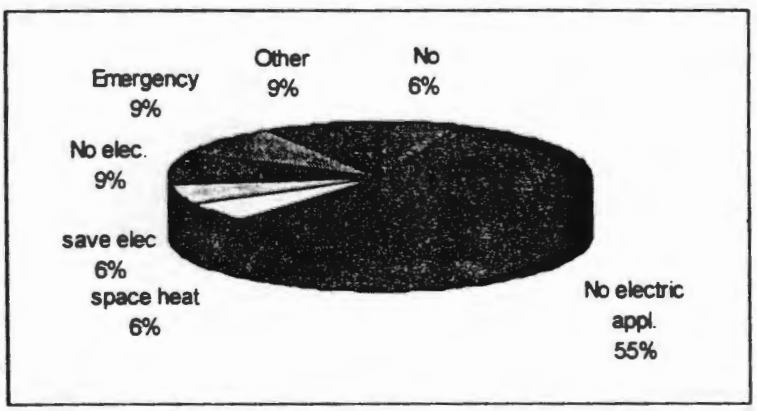

FIGURE 8.2 Paraffin usage in informal electrified houses

8.41 Place where paraffin is purchased

Respondents were asked where they purchased paraffin. This is important particularly if one considers the government's intention to shorten the paraffin distribution chain to make paraffin cheaper. If this is done, it is likely to have a negative impact on spaza shops, routers and also private homes that are dependent on the sale of paraffin for an income. As shown in Figure 8.3, of the sample, 13% of formal houses bought their paraffin from spazas, 8% purchased it from supermarkets, 9% from garages and 3% from local shops. By comparison, 79% of the respondents from informal houses purchased paraffin from supermarkets, 15% of the respondents purchased it from spazas and only one respondent bought paraffin from the garage.

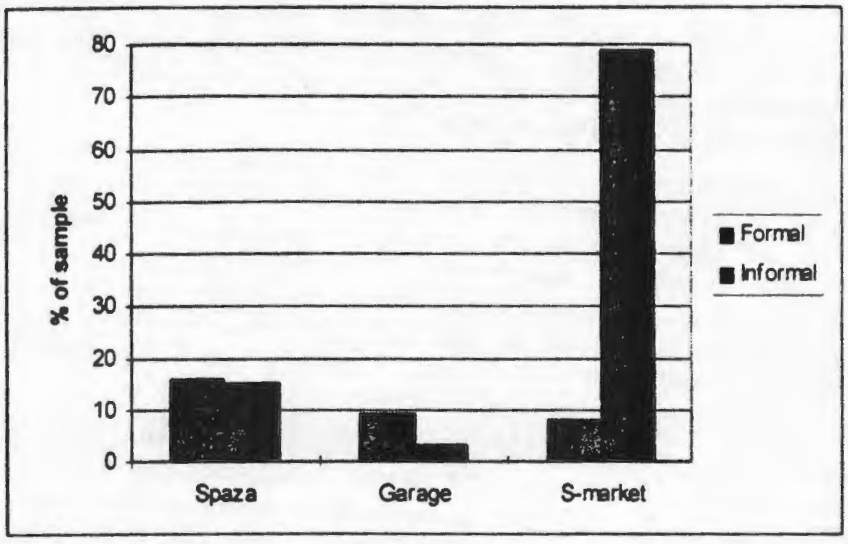

FIGURE 8.3 Place where paraffin is purchased

Improper storage of paraffin is a serious problem, particularly as it contributes to the high incidence of paraffin poisoning of children throughout the country. This study attempted to assess the success of the paraffin safety cap campaign launched by British Petroleum (BP) in the Western Cape to combat paraffin poisoning. Figure 8.4 shows that, of the respondents, 87% in formal houses and 70% in informal houses had not heard of these safety caps. These caps are designed to fit soft-drink and liquor bottles. However, only 6% of the respondents stored the paraffin in these kinds of bottles and, in fact, 12% of the respondents in the formal houses and 58% of the respondents in informal houses stored their paraffin in 5 litre containers; 9% of the respondents in informal settlements stored it in 25 litre containers. The 'other' category refers to those who store paraffin in 20 litre containers, 200 litre containers or 1.5 litre containers. The BP safety caps are not designed to fit these bottles (see Figure 8.5).

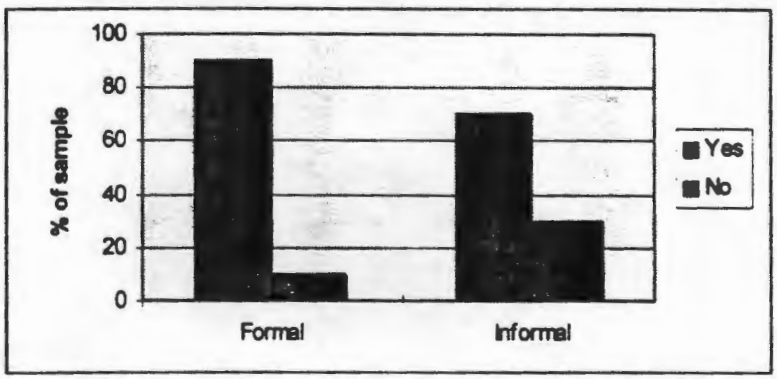

FIGURE 8.4 Level of awareness of paraffin safety caps in formal and informal households

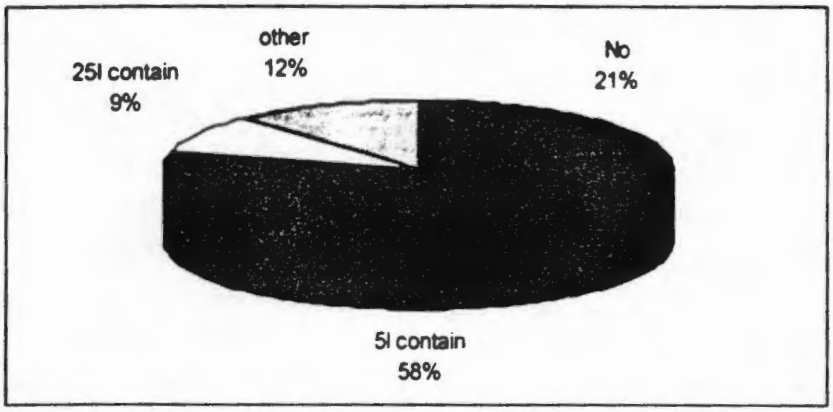

FIGURE 8.5 Containers used to store paraffin in informal houses

Conclusions and recommendations

9.1. Introduction

For a period of almost five years electricity consumers in Langa, Guguletu and Khayelitsha have been studied with the objective of understanding their behaviour with regard to electricity use. The study has comprised four Phases with the first starting in November 1990, through to Phase 4 which utilised data up to September 1995. The objective of this longitudinal study has been to examine electricity use in newly electrified, poor urban settlements in the Western Cape, by monitoring and analysing household energy consumption data and relevant socio-economic information. An important aim of the study has been to understand factors which affect the movement from multiple fuel use to greater electricity consumption or conversely, to explore reasons why electrified households continue to engage in multiple fuel use. The intention is to provide detailed information which will be of use to those involved with the electrification of these specific areas and other similar areas throughout South Africa. Accordingly, the primary output has been the compilation of information on bulk electricity and household energy consumption and an analysis of issues affecting the use of electricity and other fuels. In addition to this primary output, there were a number of other intermediate objectives, some of which included:

- a more detailed socio-economic study of formal electrified households, medium and low electricity consumers as well as recently electrified households in informal settlements in Khayelitsha,
- gathering information on how decisions are made regarding energy use patterns and appliance use, and
- highlighting determinants that shape decision making around fuel and appliance use.

This final Chapter briefly recaps regarding the location of the study and the source of information, before summarising the main research findings. In presenting the findings, an attempt is made to relate these to the previous phases in order to reveal trends over the five year period. The research findings provide a basis for the policy and future research recommendations set out toward the end of this chapter. There were a number of problems associated with the overall study which has made the summing up of the project difficult. The most serious of these was the lack of continuity with regard to personnel over the four phases and this resulted in variations in approach and methodology. These problems are discussed further in the critical analysis of the study at the end of this chapter.

Both Langa and Guguletu are representative of the older generation of poor residential areas in the Western Cape. Population estimates for Langa vary from about 65 000 to 75 000, while in Guguletu the population is estimated to be around 130 000. These two areas have a high level of access, with 72 and 90% of households respectively using electricity. In these two areas the Cape Town City Council (CCC) has 10 816 electricity customers, most of whom have been connected for more than twenty years. At the end of Phase 3 electricity payment arrears stood at R21 million for these two areas while by the end of Phase 4, this figure had risen to R22.6 million. The debt problem caused the CCC to begin replacing credit meters with prepayment meters and by September 1995, 70% of houses in these two areas had prepayment meters installed.

Khayelitsha is a relatively new and much larger township with estimates of the population varying between 300 000 and 450 000, and the number of households estimated at around 70 000. The number of electricity connections in Khayalitsha has risen sharply during the period of this study, and the total number of domestic electricity connections in both in the formal and informal sectors, in October 1995 was estimated to be 35 000.

For the purposes of Phase 4, similar to previous phases, monthly electricity consumption details for all consumers in Langa and Guguletu were provided by Cape Town City Council,

while in the case of Khayelitsha, Phambili Nombane provided electricity consumption data. In addition to analysis of electricity supply data, a survey was carried out amongst 114 formal electrified houses in the three areas to provide the information presented in this and the previous reports. During all four phases the households surveyed have remained the same, with the exception of a limited number of families that have either moved home or preferred not to continue with the survey. These families were replaced by others. Thus essentially the same people have been surveyed on four occasions over the five year period. During the first three Phases of the study informal houses were not monitored, while during Phase 4 a small sample of 33 informal houses in Site B in Khayelitsha was included in the sample. Although the sample for these informal houses is too small to be representative, it nevertheless gives an indication of fuel consumption patterns in newly electrified informal houses. Apart from the inclusion of the 33 informal houses, there were a number of other differences between the Phase 4 study and the previous three phases. These included variations in the questionnaire, a greater focus on gender dynamics, a closer examination of how different appliances were acquired, as well as a number of others which have been described in Section 2.4.1.

9.2. Research findings

9.2.1 Electricity consumption

Thorne and Qangule (1994) have pointed out that the household electricity consumption data records from the suppliers only approximates actual electricity use. In Guguletu and Langa the electricity consumption data is taken from records of monthly electricity bills and in Khayelitsha, prepayment electricity sales. Neither of these sources are entirely accurate reflections of actual use. In the former case, the reading of meters does not necessarily occur at exactly monthly intervals and the consumption is also occasionally estimated when access to meters is denied. With prepayment meters in Khayelitsha purchases do not necessarily coincide with consumption and hence averages and particularly frequency distributions could be inaccurate. In addition, it is reported that a significant proportion of the electricity supplied by Eskom to Khayalitsha is used illegally. Phase 3[1] reported that only 20 to 30% of electricity fed to the area could be accounted for in sales.

Notwithstanding these inaccuracies, Phase 3 showed that the average electricity consumption of the universe decreased relative to the initial two phases of the study and Phase 4 showed a continuation of this trend (see Figures 4.5, 4.8, 4.11). With specific regard to Khayelitsha, the Phase 3 report attributed this decrease partly to the rapid increase in the number of households which were electrified over the period, coupled with the fact that newly connected households use lower quantities of electricity. A second factor causing the decline was given as the extent of theft (or meter faults) which reduced the average calculated household electricity consumption. These reasons would appear unchanged for Phase 4 as the number of connections continued to increase and also the problem of electricity theft remains unsolved. In Langa and Guguletu the decline in consumption can be attributed, in part, to the situation regarding arrears in payments, particularly over the last two phases. A consequence of these arrears was the introduction of prepayment meters which has had a downward influence on consumption. One further general factor encouraging this decline was the regularity of electricity supply breakdowns.

9.2.2 Energy services in formal houses

The generally used household energy services include lighting, cooking, ironing, refrigeration, entertainment (media), space heating, water heating and clothes washing. In Phase 3 it was reported that only 3.5% of the sample used electricity exclusively for all these purposes. Phase 4 has reported that only 43% of the formal electrified houses and 12% of the newly electrified informal houses that have prepayment meters, use electricity for all end-uses, although this does not mean that electricity is used exclusively. Thus a large majority of households utilise multiple fuels and hence it is useful to summarise which fuels are used for the above end-uses and to indicate trends over the period of the longitudinal study.

[1]All information regarding Phase 3 of the study referred to in this section was obtained from Thorne & Qangule (1994).

9.2.2.1 *Media, lighting, refrigeration and ironing*

Electricity is used almost universally for these four end uses.

With virtually 90% of households owning televisions, they are the most commonly-owned entertainment appliance. The level of ownership has increased by about 5% over the period of the entire study. There were, however, some fluctuations in the ownership of the other entertainment appliances, such as radios, Hi-Fi's and video recorders (see Figures 5.19 and 5.20).

- With the exception of one or two households, electric lighting is used by the entire sample. High percentages of households keep candles handy for use during power failures. A smaller percentage have paraffin lamps for the same reason.
- Phase 4 showed that 92% of the sample owned refrigerators. In Langa and Guguletu most homes owned refrigerators prior to the study with a small number of additions over the five year period. In Khayelitsha a much lower proportion of households owned refrigerators at the beginning of the study and thus ownership has increased much more markedly. Besides one or two gas refrigerators, all run on electricity (see Figures 5.6 and 5.7).
- Ironing is almost entirely performed with electric irons, most of which are steam irons. In Phase 3 it was reported that 96% of the sample use electricity for ironing while in Phase 4 this percentage had declined slightly.

9.2.2.2 *Cooking*

A range of cooking appliances and associated fuels are used on a daily basis. These include electric hot-plates, electric 4-plate stoves, electric frying pans, gas stoves and paraffin stoves. While some households may only own one cooking appliance, many households own more than one and thus the various appliances are used interchangeably, depending on the particular meal that is to be cooked or which fuels are available in the home, which may in turn depend on the financial status of the household at the time.

Cooking with electricity

The use of hot-plates for daily cooking in Khayalitsha has decreased since the beginning of the study. In the initial phase 40% of the sample used hot-plates but by Phase 3 and 4 this figure had dropped to just over 20%. Conversely there was a steady increase in the use of four-plate stoves over the first three phases to a point where nearly 70% of households owned four-plate stoves. However Phase 4 recorded lower four-plate stove ownership as well as a decline in the proportion of families using them on a daily basis (see Figure 5.4). The use of electric frying pans in Khayelitsha has remained consistently low.

The picture in Langa and Guguletu is, however, somewhat different; the use of hot-plates appears to have remained constant but there has been a decrease in the use of 4-plate electric stoves over the five year period but a marked increase in the use of electric frying pans which are seen as being multi-purpose, convenient and lower electricity consumers.

Cooking with gas

Gas stoves are increasingly popular in Khayelitsha where the number of households using gas on a daily basis has increased from 20% in Phase 3 to 31% in Phase 4. Also, Phase 4 showed that over a third of the respondents in Langa and Guguletu are using gas stoves for daily cooking while during Phase 1 none of the respondents were using gas stoves. Respondents said that they used gas because it is reliable, cheap, clean and quick, although gas is seen as being dangerous by many users.

Cooking with paraffin

Paraffin continues to be used in formal houses, mainly in Langa and Guguletu where the use of paraffin for cooking has increased steadily over the five year period with Phase 4 showing that 30% of households use primus stoves on a daily basis, up from 17% during Phase 3. In Khayelitsha, Phase 4 showed that very few households (only 4%) used paraffin for cooking. This figure was little changed from previous phases of the study. Paraffin is favoured by those who use it for being cheap, quick and as a multi-purpose fuel.

9.2.2.3 *Space heating*

In general the study shows a decline in the ownership of all types of space heating appliances (see Figures 5.12 and 5.13). One exception was in Khayelitsha, where Phase 3 reported a significant increase in the use of electric bar heaters, although Phase 4 results indicate a reversal of this trend. There has been a reduction in paraffin heating in both Khayelitsha and Langa/Guguletu. The use of gas heaters has stayed at a consistently low level in all three areas.

9.2.2.4 *Water heating for bathing*

Phase 3 reported that electric geysers are utilised by a high proportion of Khayelitsha households (70%) while only a few have electric geysers in Langa and Guguletu (less than 10%). Phase 4 has produced confusing results regarding the use of electric geysers and shows the use of geysers declining from 80% of the total sample to 45%. Due to the fact that geysers are fixtures in houses it is improbable that ownership has declined and hence the decline could be explained by oversights by respondents or possibly some families have turned off their geysers to save electricity. Notwithstanding this inconsistency, those households that do not use an electric geyser, mainly utilise electric kettles or electric stoves, with about 10% of households using either gas or paraffin stoves to heat water for bathing.

9.2.2.5 *Washing of clothes*

In low-income households few people own washing machines and the majority wash their clothing by hand. Washing machines are expensive and this prevents their purchase by most families. Nevertheless, the number of households in the Langa and Guguletu sample that own washing machines has virtually doubled since Phase 3 (from 10% to 19%). A very similar trend is evident in Khayelitsha where just over 20% of households now own washing machines (see Figures 5.17 and 5.18).

9.2.3 Energy services in informal houses

Virtually all households use electricity for lighting and just under 80% use it for media. Lighting is the easiest and cheapest end-use associated with electricity as it requires little investment in appliances while one of the reasons for the high proportion of households using electricity for media is that prior to electrification many people already owned battery powered TVs, radios and Hi-Fi's. After lighting and media, there is a marked drop in the frequency of electricity use for other energy services, with only a third of the sample using it for water heating and lower proportions of the sample using it for ironing, cooking and space heating (see Figure 6.1). Thus it is evident that the surveyed informal households use multiple fuels to a greater extent than families living in formal houses.

Only four households used electricity for all end-uses. Paraffin is used by 79% of the sample with only 18% using gas. Only one respondent used wood. Expenditure on electricity is low with 45% spending less than R15 per month and a further 18% spending less than R25 per month (see Figure 6.2).

9.2.4 Appliance ownership in formal and informal houses

Energy end uses in low-income households cannot be understood without looking at patterns of appliance ownership, as the cost of appliances influences the type of fuel that is used. There are trends in appliance purchases that reflect the fact that few households can afford to buy new appliances. Mostly, only inexpensive appliances are purchased for cash. These include primus stoves, two-plate electric stoves, gas stoves, electric pans, irons, kettles and paraffin heaters, although some people use HP to buy these appliances.

The larger more expensive appliances are acquired mainly by purchasing second hand items for cash or on lay-bye, buying new appliances on lay-bye or through the use of HP. *Stokvels* or *umgalelo* (group saving schemes) are also used to finance the purchase of larger appliances. The majority of respondents bought their four-plate stoves on HP with a quarter buying them second hand for cash. Other appliances bought on HP include entertainment appliances, refrigerators and washing machines.

In the older, more established townships of Langa and Guguletu, people owned more 4-plate electric and paraffin stoves than in Khayalitsha. This situation is most likely linked to the fact

of increasing investment in electrical appliances with an increase in the period of access to electricty.

9.2.5 Gender dynamics surrounding appliance ownership

In the case of appliances that are relatively affordable, women are able to purchase them directly, although in informal households women have less freedom regarding such purchases. However, in most instances, decisions around purchasing kitchen appliances were taken jointly. The fact that decisions then are seldom made by women alone, although they are the primary users, reveals their limited access to resources and decision making in the nuclear family setting.

Appliance preference differed between formal and informal households and also between male and female respondents. Most appliances that people focused on were electrical with the exception of paraffin heaters. The most common first need in formal electrified houses were washing machines, followed by 4-plate stoves, entertainment facilities and microwave ovens. The most popular second priority appliance in formal houses included video recorders, electric frying pans, washing machines, vacuum cleaners and lastly, microwave ovens In informal houses respondents saw 4-plate stoves as the first priority, followed by refrigerators and televisions. In both formal and informal houses approximately 10% of respondents said that they would pay cash for these appliances, while most respondents said they would utilise HP.

9.2.6 Determinants of electricity consumption

Phase 3 of the study observed that increases in income, household size, and the period of access to electricity are all determinants of electricity consumption and all lead to increases in consumption. There were only five electricity consuming businesses run from home in all the areas surveyed and these used considerably more electricity than households without these activities. Households headed by women, despite earning less than their male headed counterparts, use considerably more electricity. Also the greater the variety of fuels used in a household, the lower the quantity of electricity consumed. The seasonal changes of ambient temperature effect the use of electricity and the lower the average minimum temperatures the higher the average for all consumers. In addition, results from Phase 4 indicate that electricity metering system have influenced the way in which electricity is consumed, with households having prepayment meters using less electricity than those with credit meters. It is possible that users who have recently had prepayment meters installed are becoming more aware of costs associated with each energy service and have adjusted their appliance use accordingly.

9.2.7 General

Only 9% of the respondents from the formal electrified houses stated that power supplies *never occur*. The electricity supply in newly electrified informal houses is also considered unreliable. This poor reliability causes people to depend on other fuels and appliances and thus if the supply industry wishes to encourage greater electricity use, the reliability of the electricity supply needs to be improved.

Only 43% of the formal electrified houses and 12% of the newly electrified informal houses that have prepayment meters, use electricity for all end-uses, although this does not mean that electricity is used exclusively. One of he main reasons for continued use of non-electric fuels is the high cost of electric appliances.

There is a difference between informal and formal households with regard to factors influencing the use of appliance and fuel combinations for cooking, space heating, refrigeration, lighting and laundry. While reliability, cleanliness and safety are important issues for the respondents in formal houses, cheap and multi-purpose fuel and appliances are important considerations for the respondent in informal houses.

Many of the respondents were unaware of BP's safety cap campaign to combat paraffin poisoning, and very few stored paraffin in bottles that the caps are designed to fit. There are many important issues around paraffin usage that need to be addressed. These include burns experienced by users, accidents, loss of life and property caused by paraffin stoves and lamps.

9.3. Policy recommendations

The success of the electrification programme cannot be measured in isolation from other socio-economic and political considerations. The supply of electricity alone will not ensure that people use electricity but rather there are other important determinants of electricity use, a very important one being employment. The electrification programme appears to be driven by the need to meet RDP targets instead of being a people-centred process where the actual energy needs or 'demands' of the people are met. The provision of electricity will not automatically encourage poor households to switch to electricity, especially if other fuels are perceived to be less expensive, as is often the case, or if electrical appliances remain unaffordable. Thus domestic energy policy should not be geared simply to provide electricity, but also to meet the needs that stem from access to electricity.

- In developed countries, multiple fuel use is a common and acceptable practice as a range of fuels are readily available, affordable and reliable, and the consumers are able to make informed choices regarding the fuels they use. However, multiple fuel use in the Western Cape, as in South Africa as a whole, is a legacy of apartheid and primarily a function of poverty. Low-income urban households are forced to rely on a variety of fuels for different purposes because of unreliable supplies, variable accessibility and high costs. Thus the electrification programme should be one component of integrated energy planning where all energy services are considered with regard to users needs, economic viability and environmental sustainability.
- Current energy appliance ownership and fuel use patterns do not always reflect women's energy needs but rather indicate accessibility. Policy makers therefore need to differentiate between what is construed as a 'demand' based on current fuel and appliance use and the actual demand by users.
- Domestic energy policies need to be gender sensitised by acknowledging that men and women have different roles and, therefore, different needs: energy poverty impacts on men and women in different ways. There are indications from the study that decision-making on appliance acquisition is a 'gendered' phenomenon. However more research is required to arrive at specific policy recommendations.
- There is a need to carefully consider the prepayment meter system. While there are many advantages associated with the present system some users complain that certain types of meter systems consume more electricity than others. One of the results is that Eskom continues to lose R800 000 per month in Khayelitsha alone as some users bypass the meters. This is apparently occurring throughout the country, and in the long term, could undermine the entire electrification programme. Electricity suppliers should ensure the prepayment card sale points are not only in residential areas but also where people work.
- Improvement in street lighting should become an integral part of the electrification programme.
- There appears to be great potential for small business and employment generation in appliance repairs.
- There is a need to alleviate and address the fears people have of using gas. At the same time policy needs to examine the gas chain more carefully and find ways to make gas more accessible.

9.4. Research recommendations

- Domestic energy policy research should be accorded greater importance by the DMEA.
- Mechanisms should be created whereby policies are informed by users.
- More policy related, qualitative research at the household level is needed to inform policy.
- Further research needs to be done linking gender and energy to understand the way gender dynamics affect fuel and appliance use. Such research warrants its own project as it is difficult to integrate these issues into existing studies.

- The electrification of informal settlements, electricity consumption patterns and the end use patterns needs to be monitored carefully.
- There are indications that decision making in appliance purchase and use is `gendered` phenomenon but further research is required. Future research needs to be focused and combine both quantitative and qualitative methods. Further, a gender perspective needs to be utilised; that is, instead of focusing solely on women's needs, the research should target *both* men and women to explore their individual needs, interests, priorities on appliances and fuels.

9.5. A critical analysis of the longitudinal study

This longitudinal study, `Analysis of new electrification schemes in the Western Cape' has contributed to developing an understanding of low-income households' use of energy, including electricity. In addition, the study attempts to explain some of the dynamics around multiple fuel use among poor households. The study also highlighted issues arising from the electrification of urban houses in order to inform the ongoing electrification programme in the Western Cape and, more widely, across the country. A direct 'spin-off' of the project was the capacity building among the project leaders in terms of developing skills in the areas of primary (field) research, data collection and computer packaging, policy analysis, and management.

Nevertheless, the study contains several fundamental flaws at both the conceptual planning and implementation steps that have undermined its relevance and efficacy. This four-year study is uneven and it has been difficult to effectively summarise its findings. This section identifies some of the significant oversights in the conception and implementation of the study in order to ensure that they are not repeated.

The first problem relates to the fact that this research project was not clearly set up as a longitudinal study at its outset in 1991. On the contrary, the fact that the project was renewed on an annual basis served to undermine the establishment and continuity of long-term objectives and planning. This issue may, in fact, raise questions about the priority accorded to the project and to domestic energy policy research by the DMEA. Had this research area been considered a highly relevant and important priority area (that is, not peripheral), the project could have enjoyed the benefits of continuity. Moreover, as many recommendations were repeated after the completion of each Phase, it appears that they have either been ignored by the relevant authorities or they never entered the policy-making process in any meaningful manner. For example, each Phase advocated the need to improve the reliability of the electricity supply to Langa, Guguletu and Khayelitsha but with little result. This suggests the need for a `monitoring' mechanism to be built into the project so that problems that have been identified are, in fact, addressed.

Renewing the project funding on an annual basis led to *ad hoc* planning so that the study could not foster long-term objectives and vision. The initial project proposal was developed in 1991 and while most of the objectives remained consistent over the following three phases, for each Phase new project leaders were employed and they introduced additional objectives. The study had four different project leaders with different backgrounds and training and it was impossible to create an effective and committed team of researchers, fieldworkers and data analysts to work over a four year period.

Initially, the study began on a part-time basis and it took up less than 50% of the project leader's time. By Phase 4, it had become a full-time job and the project leader was involved at every stage of the research: from fieldwork, to coding, to entering data, to securing consumption data, to analysing and writing up the report. As different researchers used different data packages, it was impossible to create a common database where information from the different phases could be stored. Changes in personnel undermined the possibilities of effectively monitoring the project to identify emerging trends and inconsistencies. New field workers were recruited in almost every phase and this prevented building stronger links with the community and the respondents involved in the study. Had stronger links been cultivated, the project would have been more likely to uncover the `real' rather than `perceived needs'. Clearly this would have enhanced the quality of the research findings and policy recommendations.

To compound the problems, although the study unfolded at a time of profound political change in South Africa, the manner in which it was originally conceived tended to ignore the broader factors at play. This is a major failing. Electricity consumption patterns were likely to be profoundly affected by the political situation in the early 1990s, including the culture of boycotts against the payment of services (which lead to massive arrears) in addition to wider socio-economic issues such as high levels of unemployment. It is difficult to understand how electricity consumption and appliance acquisition patterns could have been examined without considering the wider context.

In the future, quantitative studies, which are policy orientated, will need to draw on a larger pool of respondents so that the trends that emerge are more representative of the entire communities within which they are located. It is unlikely that the samples chosen for this study are fully representative of the areas concerned. To illustrate the point, Phase 4 included a sample of thirty two informal, newly electrified houses to represent an informal settlement of approximately 88 000 residents. It would not be unreasonable to query the accuracy of policy recommendations that are derived from such small samples. While some of the details of the findings were interesting, its relevance and direct bearing on policy proposals are difficult, if not impossible, to deduce.

9.6. Lessons for future longitudinal research

- Research objectives must be specific and clear.
- The project output must be realistic in terms of time frames.
- Additional time should be built into the project to address unforeseen problems.
- Funding for the projects need to be long-term to facilitate consistency and continuity.
- The research methodology needs to be carefully considered and adhered to consistently.
- Computer packages for data collection needs to be consistent (or at least compatible).
- There is a need to develop a single database for the entire project.
- It is vital that the same research team (including the researchers and fieldworkers) be involved throughout the study. This enables the team to establish trends and pinpoint irregularities or issues worth following up. It also helps to build rapport and trust between the communities and respondents as well as the research team.
- To ensure that the respondents maintain interest and see the relevance of the study, recommendations and findings must be fed back to the community regularly.

9.7. Making energy less accessible to the poor

Paradoxically, there is a danger that, in recognising that people engage in multiple fuel use, low income households only require a minimum supply of power supply and current. At present, Eskom is installing prepayment meters and ready boards that cost between R570 and R600 per installation. However, households in informal settlements consume, on average, only R20 worth of electricity per month and it is, therefore, unlikely that Eskom will see a return on its investment in the short term. To address this, Eskom plans to introduce a 'circuit breaker' which costs R200 less to install. Through this measure, households will be charged with a flat monthly rate for a limited supply of electricity and Eskom will depend on local authorities to collect payments. The argument being put forward by Eskom is that 'limited current/load supply' will reduce the costs of electrification, and make electricity available to more South Africans within the constraints of available finance (*Prepayment Electricity*, August 1995: 4).

This approach is 'back to front'. Eskom needs to assess why people are not using sufficient quantities of electricity, what are the barriers to using more electricity and how is it possible to remove these obstacles? If these measures are implemented, the question to be posed is what does the current electrification process hope to accomplish ultimately? Electricity remains beyond the reach of many households and the situation is compounded by the fact that electrical appliances are not readily affordable. If Eskom introduces a limited load supply in urban areas, it is unlikely that households be able to use energy-intensive appliances such as

stoves, kettles, irons and geysers unless they upgrade the connection. Should this policy materialise, it is unlikely that the quality of life of people, particularly women, will be improved. Eskom's approach is short-sighted.

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